

**STATE OF NEW MEXICO
BEFORE THE ENVIRONMENTAL IMPROVEMENT BOARD**

**IN THE MATTER OF PROPOSED REVISIONS
TO THE STATE IMPLEMENTATION PLAN
FOR THE SAN JUAN GENERATING STATION
BEST AVAILABLE RETROFIT TECHNOLOGY
DETERMINATION**



No. EIB 13- 02 (R)

PETITION FOR REGULATORY CHANGE

The New Mexico Environment Department ("Department"), pursuant to 20.1.1 NMAC - Rulemaking Procedures, petitions the Environmental Improvement Board ("Board") to approve a revision to the New Mexico regional haze State Implementation Plan ("SIP") with respect to the best available retrofit technology ("BART") determination for the San Juan Generating Station. The Board is authorized to adopt the proposed revisions by the Air Quality Control Act, NMSA 1978, §§ 74-2-2 et seq., and specifically by NMSA 1978 § 74-2-5.C (1). The proposed SIP revisions and a statement of the reasons for their adoption are attached.

The Department requests that the Board schedule the hearing during its regular meeting in September, 2013. The Department anticipates that the time necessary to conduct the hearing will be one to two days.

Respectfully submitted,

NEW MEXICO ENVIRONMENT DEPARTMENT
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STATEMENT OF REASONS

The New Mexico Environment Department (“Department”) proposes revisions to the regional haze State Implementation Plan (“SIP”) approved by the New Mexico Environmental Improvement Board (“Board”) on June 3, 2011. The revisions affect only the determination of the best available retrofit technology (“BART”) for the San Juan Generating Station (“San Juan”) operated by Public Service Company of New Mexico (“PNM”). The remainder of the 2011 regional haze SIP was approved by the U.S. Environmental Protection Agency (“EPA”) on November 27, 2012. *See* 77 Fed. Reg. 70,693 (Nov. 27, 2012). These proposed SIP revisions, if adopted by the Board and approved by EPA, would effectuate a tentative agreement reached between the State of New Mexico, PNM, and the EPA, to settle litigation over EPA’s federal implementation plan (“FIP”) for BART at San Juan.

Background

The federal regional haze rule, 40 C.F.R. §§ 51.308 – 51.309, requires States to submit SIPs to address visibility impairment caused by regional haze in 156 federally-protected parks and wilderness areas, known as Class I areas, including nine such areas in New Mexico. The rule provides for two alternative approaches, contained in 40 C.F.R. § 51.308 and 40 C.F.R. § 51.309. (“Sections 308 and 309” respectively). Section 309 is an alternative available only to certain western states and tribes, and contains provisions to implement the recommendations of the Grand Canyon Visibility Transport Commission (“GCVTC”). Section 308 provides the default approach for states that are not eligible for, or chose not to opt into, the Section 309 approach.

The Board approved a SIP under Section 309 on December 31, 2003, and Governor Richardson then submitted the SIP to EPA for approval. In accordance with the provisions of the regional haze rule then applicable, the 2003 SIP addressed New Mexico’s BART obligations with respect to sulfur dioxide (“SO₂”) by creating SO₂ emission milestones and a “backstop” emissions trading program, but deferred BART regulations with respect to particulate matter (“PM”) and nitrogen oxides (“NO_x”).

EPA action on the SIP was delayed in part due to two challenges to the regional haze rule in the U.S. Court of Appeals for the District of Columbia Circuit, and additional rule makings necessitated by the decisions in those cases. *See American Corn Growers v. EPA* 291 F.3d 1 (D.C. Cir. 2002); *Center for Energy and Economic Development v. EPA*, 398 F.3d 653 (D.C. Cir. 2005). In response to the latter case, the EPA issued a revised rule in 2006, which corrected the provisions struck down by the court, and allowed States to submit revised SIPs under Section 309 by December 17, 2007. 71 Fed. Reg. 60612 (Oct. 13, 2006). New Mexico, however, did not meet the 2007 deadline.

In February 2011, the Department proposed a revised Section 309 SIP, which was approved by the Board on June 3, 2011. Thereafter, Governor Martinez submitted the SIP to EPA, which received it on July 5, 2011. The 2011 SIP contained BART determinations for PM and NO_x for San Juan, which is the only facility in New Mexico that is subject to BART requirements under the CAA and EPA's implementing regulations. Specifically, for NO_x at San Juan, the SIP determined that BART is selective non-catalytic reduction ("SNCR"), with an emission limit of 0.23 lb/MMBtu.

Notwithstanding New Mexico's BART determination, on August 22, 2011, EPA promulgated a federal implementation plan ("FIP") containing a different NO_x BART determination for San Juan – selective catalytic reduction ("SCR"), with an emission limit of 0.05 lbs/MMBtu. 76 Fed. Reg. 52,388 (Aug. 22, 2011). In explaining the timing of its promulgation of the FIP, EPA pointed to the existence of a consent decree deadline for final action on a separate but related part of the CAA, the visibility element of the interstate transport provisions at Section 110(a)(2)(D). Because EPA was obligated to act under that provision by August 5, 2011,¹ and because EPA determined that additional NO_x reductions from San Juan were necessary to satisfy Section 110(a)(2)(d), EPA took the position that the interests of certainty and efficiency would best be served by promulgating a NO_x BART FIP for San Juan at the same time.

New Mexico sought judicial review of the NO_x BART FIP in the U.S. Court of Appeals for the Tenth Circuit, as provided for in the CAA, arguing among other things that EPA must first evaluate and approve or disapprove the NO_x BART portion of the SIP before promulgating a FIP addressing that requirement. That case (consolidated with a separate appeal by PNM) has been briefed, and oral arguments were held on October 23, 2012, but the court has not issued a decision.

Throughout the course of the litigation, discussions among the parties continued, and on February 15, 2013, New Mexico, EPA, and PNM signed a tentative settlement agreement that, when fully implemented, would dispose of the case. The terms of the tentative settlement are recorded in a "Term Sheet." The Term Sheet provides for the revisions to New Mexico's SIP with respect to BART for San Juan that are the subject of this requested regulatory change.

The core agreement as provided in the Term Sheet is that PNM would retire Units 2 and 3 at San Juan by December 31, 2017, and install the SIP technology (SNCR) on Units 1 and 4 within 15 months of EPA approval of this revised SIP.

¹ EPA Administrator Lisa P. Jackson signed the FIP on August 4, 2011. The FIP was then published in the Federal Register on August 22, 2011.

Request for Regulatory Change

This request for regulatory change proposes to replace in the 2011 “§ 309(g)” SIP :

- Chapter 10: Best Available Retrofit Technology (BART) Evaluation,
- Appendix D, New Mexico Environment Department BART Determination for San Juan Generating Station

with revised versions of those documents. The documentation relied upon in making the BART determination contained in Appendix D will be presented as exhibits and will be available for public review.

In addition, the request adds to the SIP Appendix G, the aforementioned Term Sheet.

The purpose of this change is to complete New Mexico’s outstanding obligations for regional haze. Moreover, as discussed within the SIP and as will be further demonstrated by testimony and evidence presented at the hearing if it is granted, the proposed SIP revisions would:

- Result in the following percent reductions of pollutant emissions, as compared to current emissions: nitrogen oxides 62%, sulfur dioxide 67%, and particulate matter 50%.
- Achieve visibility improvement at all affected Class I areas that are virtually indistinguishable to the human eye from EPA’s FIP, at substantially lower costs. Specifically, the total capital costs of the FIP are estimated at \$861,871,000, as compared to \$34,556,000 for the installation of SNCR at Units 1 and 4.
- Reduce raw material usage at the facility, including limestone, activated carbon, coal and No. 2 diesel oil.
- Result in a substantial decrease in particulate matter emissions from coal processing and handling.
- Decrease water usage by up to approximately 53%.

This “statement of reasons for the regulatory change” accompanying the petition is submitted in accordance with 20.1.1.300.B NMAC. If the hearing is granted, the Department will also submit a “proposed statement of reasons for adoption” at the time of filing a notice of intent, in accordance with 20.1.1.302 NMAC.

The first part of the paper discusses the importance of understanding the cultural context of the research. It highlights the need for researchers to be sensitive to the values and beliefs of the communities they are studying. This is particularly important in the field of education, where cultural differences can significantly impact learning outcomes.

The second part of the paper focuses on the methodology used in the study. It describes the process of selecting participants, collecting data, and analyzing the results. The authors emphasize the importance of using a mixed-methods approach to gain a comprehensive understanding of the research topic.

The third part of the paper presents the findings of the study. It discusses the results of the quantitative data analysis and the insights gained from the qualitative interviews. The authors conclude that there are significant differences in learning outcomes between the two groups, and these differences can be attributed to cultural factors.

The final part of the paper discusses the implications of the findings for future research and practice. It suggests that educators should be aware of the cultural context of their students and tailor their teaching methods accordingly. The authors also recommend further research to explore the underlying reasons for the observed differences.

CHAPTER 10: BEST AVAILABLE RETROFIT TECHNOLOGY (BART) EVALUATION

10.1 Introduction

In 1999, the EPA published a final rule to address a type of visibility impairment known as regional haze. See 64 Fed. Reg. 35714, July 1, 1999. The regional haze rule requires States to submit state implementation plans (SIPs) to address regional haze visibility impairment in 156 Federally-protected parks and wilderness areas. The 1999 rule was issued to fulfill a long-standing EPA commitment to address regional haze under the authority and requirements of sections 169A and 169B of the Clean Air Act (CAA).¹

As required by the CAA, the EPA included in the final regional haze rule a requirement for Best Available Retrofit Technology (BART) for certain large stationary sources. The regulatory requirements for BART were codified at 40 CFR § 51.308(e) and in definitions that appear in 40 CFR § 51.301.

The BART-eligible sources are those sources which have the potential to emit 250 tons per year or more of a visibility impairing air pollutant, were put in place between August 7, 1962 and August 7, 1977, and whose operations fall within one or more of 26 specifically listed source categories. Under the CAA, BART is required for any BART-eligible source which a State determines “emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any such area.” Accordingly, for stationary sources meeting these criteria, States must address the BART requirement when they develop their regional haze SIPs.

The EPA published a second rulemaking on June 6, 2005 that made changes to the Final Rule published July 1, 1999. The second rulemaking was in response to a U.S. Court of Appeals for the D.C. Circuit ruling that vacated part of the regional haze rule, *American Corn Growers v. EPA*, 291 F.3d 1 (D.C. Cir. 2002). The June 6, 2005 Final Rule required the BART analysis to include an analysis of the degree of visibility improvement resulting from the use of control technology at BART-subject sources; included new BART Guidelines contained in a new Appendix Y to Part 51; and added the requirement that States use Appendix Y for determining BART at certain large electrical generating units (EGUs).

The Guidelines also contained specific presumptive limits for SO₂ and NO_x for certain large EGUs based on fuel type, unit size, cost effectiveness, and presence or absence of pre-existing controls. The Guidelines directs states to generally require owners and operators to meet the presumptive limits at coal-fired EGUs greater than 200 MW at power plants with a total generating capacity greater than 750 MW. The presumptive limits for NO_x are based on coal type, boiler type and whether post-combustion controls are already installed at the source.

As originally adopted by the Board on June 3, 2011, this Chapter 10 of New Mexico’s 309(g) SIP contained the Department’s determinations of BART for the San Juan Generating Station (“San Juan”) with respect to sulfur dioxide (“SO₂”), particulate matter (“PM”), and nitrogen oxides (“NO_x”). In November 2012, the EPA promulgated final approval of these BART determinations with respect to SO₂ and PM, but took no action on New Mexico’s NO_x BART determination for San Juan. 77 Fed. Reg. 36,044 (Nov. 27, 2012). EPA had previously issued a federal implementation plan (“FIP”) containing a different NO_x BART determination for San Juan. 76 Fed. Reg. 52,388 (Aug. 22, 2011).

To resolve litigation arising from New Mexico’s and EPA’s incompatible San Juan NO_x BART determinations, New Mexico, the U.S. EPA, and PNM reached a tentative agreement on an alternative plan to address pollution control requirements for the San Juan Generating Station under the Clean Air

Act's requirements for regional haze and interstate transport for visibility. *See* Appendix G, Term Sheet Between the U.S. Environmental Protection Agency, Public Service Company of New Mexico and the State of New Mexico ("Term Sheet"). This plan, referred to hereinafter as the "State Alternative" calls for the complete shutdown of Units 2 and 3 by the end of 2017, and the installation of selective non-catalytic reduction ("SNCR") on Units 1 and 4.

In order to maintain New Mexico's BART analyses together in one location within the SIP, this revised Chapter 10 continues to contain a description of the statewide BART determination process, reviews the 2011 BART determinations for San Juan, and adopts the State Alternative as New Mexico's NO_x BART determination for San Juan.

10.2 SO₂: Regional SO₂ Milestone and Backstop Trading Program

New Mexico is a "§309" (40 CFR § 51.309) state participating in the Regional SO₂ Milestone and Backstop Trading Program. §308(e)(2) provides states with the option to implement or require participation in an emissions trading program or other alternative measure rather than to require sources subject to BART to install, operate, and maintain additional control technology to meet an established emission limit on a continuous basis. However, the alternate program must achieve greater reasonable progress than would be accomplished by installing BART at each source subject to BART. A demonstration that the alternate program can achieve greater reasonable progress is prescribed by §308(e)(2)(i). Section 309(d)(4)(i) requires that the SO₂ milestones established under the Plan "...must be shown to provide for greater reasonable progress than would be achieved by application of BART pursuant to §51.308(e)(2)."

New Mexico participated in creating a detailed report entitled "Demonstration that the SO₂ Milestones Provide Greater Reasonable Progress than BART" covering SO₂ emissions from all states participating in the Regional SO₂ Milestone and Backstop Trading Program. The document is included in New Mexico's §309 Regional Haze SIP submittal to EPA.

As part of the §309 program, participating states, including New Mexico, must submit an annual Regional Sulfur Dioxide Emissions and Milestone Report that compares actual emissions to pre-established milestones. Participating states have been filing these reports since 2003. Each year, states have been able to demonstrate that actual SO₂ emissions are well below the milestones. The actual emissions and their respective milestones are shown in Table 10-1 below:

Year	Reported SO ₂ Emissions (tons)	3-year Milestone Average (tons)
2003	330,679	447,383
2004	337,970	448,259
2005	304,591	446,903
2006	279,134	420,194
2007	273,663	420,637
2008	244,189	378,398

On November 27, 2012, the EPA approved New Mexico's SO₂ backstop trading program under 40 CFR §§ 51.309 and 51.308(e)(2) as achieving greater reasonable progress than BART. 77 Fed. Reg. 36,044. Notwithstanding the fact that the BART requirement has thus been satisfied statewide with respect to SO₂, additional SO₂ reductions will be made at the San Juan Generating Station under the "State Alternative" described below.

10.3 Determination of Sources Subject to BART

Under the BART Guidelines, a state is required to take the following steps in its BART analysis: (a) identify all "BART eligible" sources, (b) identify sources "subject to BART," (c) determine what BART is for each source subject to BART, and (d) establish emission limits consistent with the BART determination for each source subject to BART. *See* 70 Fed. Reg. at 39,158. In New Mexico, the result of steps (a) and (b) was the determination that only one source is subject to BART, the San Juan Generating Station, as discussed below. Steps (c) and (d) as applied to San Juan are discussed in section 10.4 below.

10.3.1 BART Eligible Sources

Under the CAA and the BART Guidelines, states are required to identify each source that satisfies all of the following criteria: it falls within the 26 listed source categories as listed in the CAA, it was "in existence" on August 7, 1977 but was not "in operation" before August 7, 1962, and it has a current potential to emit that is greater than 250 tons per year of any single visibility impairing pollutant.

In May 2006, the Department conducted a review of sources potentially subject to the BART rule. New Mexico identified 11 sources as BART-eligible sources as part of this review. The 11 BART eligible sources identified in New Mexico are Giant Refining, Ciniza Refinery (now Western Refining Southwest, Gallup Refinery); Public Service Company of New Mexico, San Juan Generating Station Boilers 1 through 4; Giant Refining San Juan Refinery (now Western Refining Southwest, Bloomfield Refinery) Unit #1 fluid catalytic cracking unit electrostatic precipitator; DEFS Artesia Gas Plant (now DCP Midstream Artesia Gas Plant) sulfur recovery unit; Amoco Empire Abo (now Frontier Field Services Empire Abo Gas Plant) sulfur recovery unit; Marathon Indian Basin Gas Plant (now Oxy USA WTP Indian Basin Gas Plant) sulfur recovery unit; DEFS Linam Ranch Gas Plant (now DCP Midstream Linam Ranch Gas Plant) sulfur recovery unit, Dynegy Saunders (now Versado Gas Processors Saunders Gas Plant) sulfur recovery unit; Southwestern Public Service Cunningham Station; Southwestern Public Service Maddox Station; El Paso Rio Grande Generating Station.

10.3.2 Sources Subject to BART

After determining BART-eligibility, the State must then determine whether the source is potentially-subject-to-BART. EPA finalized several options that allowed States flexibility when making the determination of whether a source "emits any pollutants which may reasonably be anticipated to cause or contribute to any visibility impairment."

Option 1: All BART-eligible sources are Subject to BART

EPA provided the States with the discretion to consider all BART-eligible sources within the State to be "reasonably anticipated to cause or contribute" to some degree of visibility impairment in a Class I area. EPA held that this option is consistent with the American Corn Growers court's decision, as it would be an impermissible constraint of State authority for the EPA to force States to conduct individualized analyses in order to determine that a BART-eligible source "emits any air pollutant which may reasonably anticipated to cause or contribute to any impairment of visibility in any [Class I] area."

Option 2: All BART-Eligible Sources Do Not Cause or Contribute to Regional Haze

EPA also provided States with the option of performing an analysis to show that the full group of BART-eligible sources in a State may not, as a whole, be reasonably anticipated to cause or contribute to any

visibility impairment in Class I areas. Although the option was provided, EPA did also state that it anticipated that in most, if not all States, BART eligible-sources are likely to cause or contribute to some level of visibility impairment in at least one Class I area.

Option 3: Case-by-Case BART Analysis

The final option provided to the States was to consider the individual contributions of a BART-eligible source to determine whether the facility is subject-to-BART. Specifically, EPA allowed States to choose to undertake an analysis of each BART-eligible source in the State in considering whether each such source "emit[s] any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any [Class I] area." The Guidelines provide that a source with a visibility impact of 1.0 dv should be considered to *cause* visibility impairment, and a source with a visibility impact of 0.5 dv should be considered to *contribute* to visibility impairment. Alternatively, States may choose to presume that all BART-eligible sources within the State meet this applicability test, but provide sources with the ability to demonstrate on a case-by-case basis that this is not the case.

The Department determined that the third option is the most consistent with the *American Corn Growers* case, as this option provides a rebuttable method for the evaluation of the visibility impact from a single source. If the air dispersion modeling analysis shows that a facility causes or contributes to Regional Haze, then it is required to address BART. A State is also provided with flexibility under this option, as it may exempt from BART any source that is not reasonably anticipated to cause or contribute to visibility degradation in a Class I area.

The Western Regional Air Partnership (WRAP) performed the initial BART modeling for the state of New Mexico. The procedures used are outlined in the WRAP Regional Modeling Center (RMC) BART Modeling Protocol that is available at:

http://pah.cert.ucr.edu/aqm/308/bart/WRAP_RMC_BART_Protocol_Aug15_2006.pdf

The basic assumptions in the WRAP BART CALMET/CALPUFF modeling used for New Mexico are as follows:

- Use of three years of modeling of 2001, 2002, and 2003.
- Visibility impacts due to emissions of SO₂, NO_x and primary PM emissions were calculated. PM emissions were modeled as PM_{2.5}.
- Visibility was calculated using the Original IMPROVE equation and Annual Average Natural Conditions.

Initial modeling was performed for the 11 source complexes in New Mexico with visibility estimated from the sources' SO₂, NO_x, and PM emissions. Then for those sources whose 98th percentile visibility impacts at any Class I area due to their combined SO₂, NO_x, and PM emissions exceeded the 0.5 dv significance threshold, the separate contribution to visibility at Class I areas was assessed for SO₂ alone (SO₄), NO_x alone (NO₃), PM alone (PMF) and combined NO_x plus PM emissions (NO₃ + PMF).

Of the 11 source complexes analyzed, only one source complex's visibility impacts at any Class I area due to combined SO₂, NO_x, and PM emissions exceeded the 0.5 dv threshold (PNM San Juan Generating Station Boilers #1-4). Of the 10 other source complexes, none exceed a 0.33 dv impact. See Appendix C. Consequently, only the PNM San Juan Boilers #1-4 were subjected to a BART determination.

On November 9, 2006, the New Mexico Environment Department informed PNM that the modeling performed by the WRAP indicated the visibility impairment from the San Juan Generating Station (SJGS)

was over the 0.5 dv threshold, and was therefore subject to a BART determination. In response, Black & Veatch (B&V), on behalf of PNM, submitted the BART Modeling Protocol document which described the CALPUFF modeling methodology to be used as part of the BART engineering evaluation for Units 1-4 at the SJGS. The results are presented in Table 10-2 below.

**Table 10-2: Visibility Impact Analysis of PNM's San Juan Generating Station
NM SRC02 Unit # 350450902, PNM SJ #1-4: SO₂ = 35,735 TPY; NO_x = 38,763 TPY; PM = 3,884 TPY**

Annual Average Natural Conditions

Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance	98th Percentile for Each Year			98th
	(km)	2001	2002	2003	3 year AVG
Mesa Verde NP	40	5.54	5.34	5.30	5.40
Weminuche Wilderness	98	2.24	2.99	2.41	2.55
San Pedro Parks Wilderness	155	3.80	4.07	4.14	4.01
La Garita Wilderness	169	1.63	1.82	1.77	1.74
Canyonlands NP	170	6.21	4.33	4.44	4.99
Black Canyon Gunnison NM	203	2.38	2.27	2.43	2.36
Bandelier NM	210	2.47	2.90	3.08	2.82
Petrified Forest NP	213	1.62	1.27	1.03	1.31
West Elk Wilderness	216	2.14	1.90	2.20	2.08
Arches NP	222	4.06	3.71	3.59	3.79
Capitol Reef NP	232	4.00	2.02	2.35	2.79
Pecos Wilderness	248	2.17	2.63	2.81	2.53
Wheeler Peak Wilderness	258	1.94	1.73	1.97	1.88
Great Sand Dunes NM	269	1.47	1.59	1.74	1.60
Maroon Bells-Snowmass WA	271	1.19	1.27	1.15	1.21
Grand Canyon NP	285	2.12	1.50	1.18	1.60

NM SRC02 Unit # 350450902, PNM SJ #1-4: PM Only (PM = 3,884 TPY)
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance	98th Percentile for Each Year			98th
	(km)	2001	2002	2003	3 year AVG
Mesa Verde NP	40	0.86	0.96	1.13	0.98
Weminuche Wilderness	98	0.15	0.24	0.25	0.21
San Pedro Parks Wilderness	155	0.25	0.28	0.22	0.25
La Garita Wilderness	169	0.06	0.08	0.09	0.08
Canyonlands NP	170	0.28	0.20	0.22	0.23
Black Canyon Gunnison NM	203	0.09	0.11	0.07	0.09
Bandelier NM	210	0.13	0.19	0.17	0.16
Petrified Forest NP	213	0.05	0.03	0.05	0.05
West Elk Wilderness	216	0.07	0.09	0.07	0.08
Arches NP	222	0.19	0.19	0.15	0.17
Capitol Reef NP	232	0.12	0.07	0.09	0.09
Pecos Wilderness	248	0.08	0.10	0.10	0.09
Wheeler Peak Wilderness	258	0.07	0.06	0.07	0.06
Great Sand Dunes NM	269	0.07	0.05	0.06	0.06
Maroon Bells-Snowmass WA	271	0.04	0.04	0.03	0.04
Grand Canyon NP	285	0.08	0.04	0.05	0.05

NM SRC02 Unit # 350450902, PNM SJ #1-4: NOx Only (NOx = 38,763 TPY)
Annual Average Natural Conditions
Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance	98th Percentile for Each Year			98th
	(km)	2001	2002	2003	3 year AVG
Mesa Verde NP	40	3.59	3.73	3.24	3.52
Weminuche Wilderness	98	1.66	2.15	1.71	1.84
San Pedro Parks Wilderness	155	2.70	2.74	2.89	2.78
La Garita Wilderness	169	1.09	1.30	1.22	1.20
Canyonlands NP	170	4.28	3.22	2.79	3.43
Black Canyon Gunnison NM	203	1.67	1.72	1.86	1.75
Bandelier NM	210	1.69	2.13	2.23	2.02
Petrified Forest NP	213	0.80	0.70	0.30	0.60
West Elk Wilderness	216	1.22	1.44	1.60	1.42
Arches NP	222	3.22	2.50	2.40	2.71
Capitol Reef NP	232	2.89	0.92	1.45	1.75
Pecos Wilderness	248	1.49	1.72	1.94	1.72
Wheeler Peak Wilderness	258	1.15	1.09	1.36	1.20
Great Sand Dunes NM	269	1.09	1.00	1.10	1.07
Maroon Bells-Snowmass WA	271	0.76	0.88	0.88	0.84
Grand Canyon NP	285	1.56	0.80	0.44	0.93

NM SRC02 Unit # 350450902, PNM SJ #1-4: SO₂ Only (SO₂ = 35,735 TPY)

Annual Average Natural Conditions

Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance	98th Percentile for Each Year			98th
	(km)	2001	2002	2003	3 year AVG
Mesa Verde NP	40	2.78	3.17	3.14	3.03
Weminuche Wilderness	98	1.28	1.23	0.89	1.13
San Pedro Parks Wilderness	155	1.77	2.13	1.72	1.87
La Garita Wilderness	169	0.81	0.89	0.70	0.80
Canyonlands NP	170	2.65	1.79	2.06	2.17
Black Canyon Gunnison NM	203	0.92	1.03	0.89	0.95
Bandelier NM	210	1.17	1.62	1.24	1.34
Petrified Forest NP	213	0.94	0.83	0.94	0.91
West Elk Wilderness	216	0.75	0.79	0.59	0.71
Arches NP	222	1.74	1.22	1.33	1.43
Capitol Reef NP	232	1.68	1.47	1.32	1.49
Pecos Wilderness	248	1.09	1.16	1.24	1.16
Wheeler Peak Wilderness	258	1.00	0.86	1.06	0.97
Great Sand Dunes NM	269	0.64	0.69	0.68	0.67
Maroon Bells-Snowmass WA	271	0.54	0.62	0.36	0.51
Grand Canyon NP	285	1.18	0.78	0.73	0.90

NM SRC02 Unit # 350450902, PNM SJ #1-4: PM plus NO_x (NO_x = 38,763 TPY; PM = 3,884 TPY)

Annual Average Natural Conditions

Class I Area with at least 1 receptor within 300 km of source

Class I Area	Minimum Distance	98th Percentile for Each Year			98th
	(km)	2001	2002	2003	3 year AVG
Mesa Verde NP	40	4.27	4.06	3.46	3.93
Weminuche Wilderness	98	1.74	2.28	1.76	1.93
San Pedro Parks Wilderness	155	2.85	2.87	3.07	2.93
La Garita Wilderness	169	1.15	1.36	1.30	1.27
Canyonlands NP	170	4.39	3.33	2.91	3.54
Black Canyon Gunnison NM	203	1.73	1.84	1.90	1.82
Bandelier NM	210	1.77	2.29	2.31	2.12
Petrified Forest NP	213	0.83	0.72	0.31	0.62
West Elk Wilderness	216	1.26	1.50	1.64	1.47
Arches NP	222	3.30	2.65	2.50	2.82
Capitol Reef NP	232	3.06	0.95	1.50	1.83
Pecos Wilderness	248	1.55	1.77	2.04	1.79
Wheeler Peak Wilderness	258	1.20	1.12	1.40	1.24
Great Sand Dunes NM	269	1.14	1.05	1.15	1.11
Maroon Bells-Snowmass WA	271	0.78	0.91	0.91	0.87
Grand Canyon NP	285	1.60	0.82	0.45	0.96

10.4 Summary of BART Determinations for San Juan

Clean Air Act § 169A(g)(7) directs States to consider five factors in making BART determinations. The regional haze rule codified these factors in 40 CFR § 51.308(e)(1)(ii)(B), which directs States to identify the "best system of continuous emissions control technology" taking into account "the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use at the source, and the remaining useful life of the source."

The BART regulations define BART as meaning "...an emission limitation based on the degree of reduction achievable through the application of the best system of continuous emission reduction for each pollutant which is emitted by ... [a BART-eligible source]. In its guidance, EPA was clear that each State must determine the appropriate level of BART control for each source that is determined to be subject-to-BART. In making a BART determination, a State must consider the following factors:

- (1) The costs of compliance;
- (2) The energy and non-air quality environmental impacts of compliance;
- (3) Any existing pollution control technology in use at the source;
- (4) The remaining useful life of the source; and
- (5) The degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

To consider these factors, New Mexico applied the following 5 step process as specified in the BART Guidelines at Appendix Y to 40 CFR Part 51:

Step 1 – Identify All Available Retrofit Control Technologies

Step 2 – Eliminate Technically Infeasible Options

Step 3 – Evaluate Control Effectiveness of Remaining Control Technologies

Step 4 – Evaluate Impacts and Document the Results

- a) Costs of Compliance
- b) Energy Impacts
- c) Air quality environmental impacts
- d) Non-air environmental impacts
- e) Remaining useful life

Step 5 – Evaluate Visibility Impacts

The Department applied the 5 step process to San Juan, as described in detail in Appendix D. The results are summarized below.

10.4.1 Particulate Matter

Based on the five factor analysis, the Department determined in 2011 that BART for Units 1-4 for particulate matter ("PM") is the existing pulse jet fabric filter control technology and an existing emission rate of 0.015 lb/MMBtu. The Department's determination of BART was based on the following results of the full five factor analysis:

1. Each of Units 1-4 is equipped with a pulse jet fabric filter (PJFF) and is subject to a federally-enforceable emission limit of 0.015 lb PM/MMBtu.

2. The Department reviewed both the cost-effectiveness and incremental cost-effectiveness of additional control technology (WESP) and found these costs to be excessive.
3. There are no non-air impacts associated with the WESP technology.
4. There are additional energy impacts associated with the WESP technology and the Department considers these costs to be reasonable.
5. The Department reviewed the visibility improvement that resulted from the installation of the consent decree technology (PJFF and LNB/OFA) and that would result from the addition of WESP technology. The Department determined that on a facility-wide basis the visibility improved by 1.06 deciviews (dv) from the installation of the consent decree technology at Mesa Verde National Park (Mesa Verde). The installation of WESP would result in a facility-wide improvement of 0.62 dv at Mesa Verde.

On November 27, 2012, the EPA approved New Mexico's determination that PJFF is BART for PM at San Juan. 77 Fed. Reg. 36,044. Notwithstanding the fact that the BART requirement has thus been satisfied with respect to PM, additional PM reductions will be made at the San Juan Generating Station under the "State Alternative" described below.

10.4.2 Nitrogen Oxides

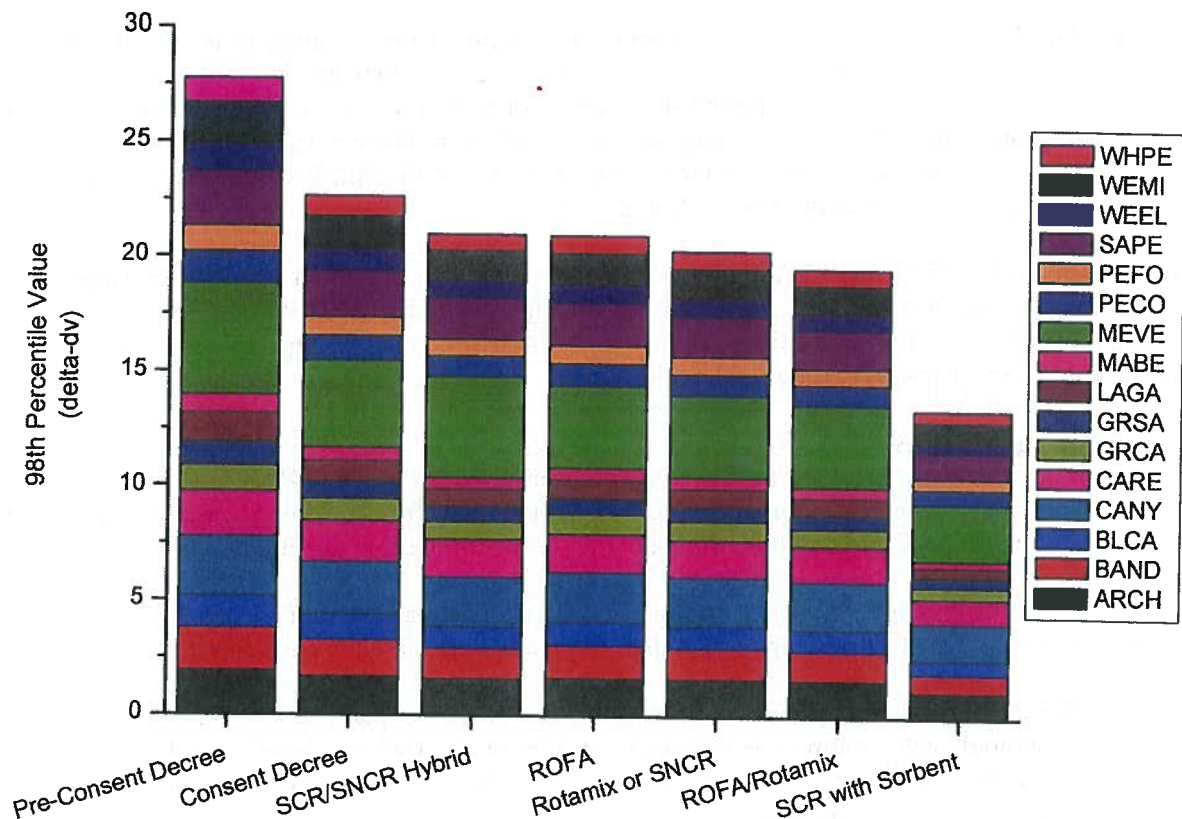
Based on the five factor analysis, the Department determined in 2011 that BART for Units 1-4 for NO_x is SNCR technology and an emission rate of 0.23 lb/MMBtu on a 30-day rolling average. The Department's determination of BART was based on the following results of the five factor analysis:

1. SNCR technology is considered cost-effective at an average cost of \$3,494 dollars per ton of NO_x removed. SNCR technology will reduce the facility annual NO_x emissions by 4,900 tons.
2. The SNCR technology will result in additional energy impacts and non-air impacts. The SNCR technology will require a new reagent system and a reagent storage system. The Department considered these additional costs in the review of the overall cost-effectiveness of SNCR and found these costs to be reasonable.
3. The Department reviewed the visibility improvement that resulted from the installation of the SNCR technology. The Department determined that on a facility-wide basis the visibility improved by 0.25 dv at San Pedro Parks, 0.22 dv at Mesa Verde, and 0.21 at Bandelier.
4. An emission limit of 0.23 lb NO_x/MMBtu at each of Units 1-4 equals the EPA's established presumptive limit for dry-bottom, wall-fired boilers burning sub-bituminous coal.
5. The Department reviewed additional economic information provided by PNM that analyzed the economic impact to ratepayers in New Mexico. PNM estimates indicate the cost of control technology beyond SNCR would be financially burdensome and cause economic hardship to low-income New Mexicans. According to the U.S. Census Bureau, as of 2009, 18 percent of New Mexicans were living below the poverty line, as defined by the federal poverty standards. PNM estimates a rate increase of \$11.50 per year per residential ratepayer from the installation of SNCR versus an estimated rate increase of \$82.00 per year from the installation of SCR.

The visibility improvement projected for each Class I area from the installation of various NO_x control technologies is shown in

Figure 10-1.

Figure 10-1: Visibility Improvement from NO_x BART Controls at San Juan Generating Station



Notwithstanding this 2011 NO_x BART determination applicable to all four units, which the Department believes would satisfy all applicable requirements, the Department has determined that the State Alternative would result in additional visibility improvements and other air and non-air benefits, as described below, and therefore is preferable to the 2011 NO_x BART determination.

10.4.3 State Alternative

As noted in the Introduction above, on February 15, 2013, New Mexico, EPA, and PNM signed a tentative agreement (Term Sheet) to address the CAA requirements for regional haze and interstate transport for visibility at the San Juan Generating Station. Although the agreement arose from a dispute over the NO_x BART determination, its terms will also result in reduction of PM, SO₂, and other pollutants including greenhouse gases.

In accordance with the Term Sheet, PNM submitted to the Department in March 2013 a revised 5-factor BART analysis that includes consideration of the State Alternative. As documented in Appendix D of

this SIP, the Department has reviewed the revised BART analysis, and has determined that the State Alternative satisfies the BART requirements of the CAA and 40 C.F.R Part 51 Appendix Y.

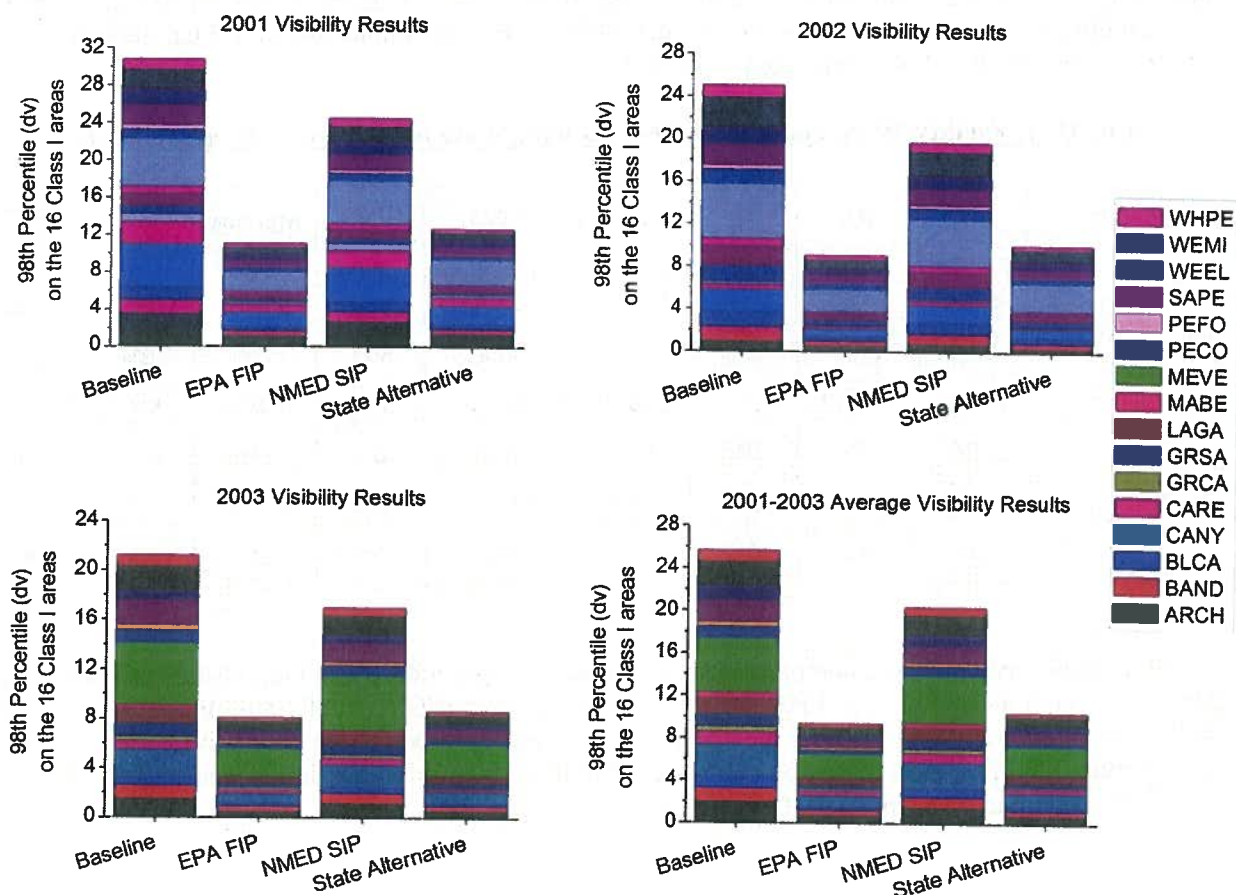
The comparison of the State Alternative to the Department's BART determination of SNCR on all four units and the installation of SCR on all four units (EPA's Federal Implementation Plan decision; 76 FR 52388, August 22, 2011) is summarized in Table 10-3.

Table 10-3: Facility-Wide Pollutant Emissions from State Alternative, FIP and NMED SIP

Scenario	NO_x	SO₂	PM	CO	CO₂	VOC	Mercury	Non-Hg	Acid Gases
Current	21,000	10,500	2,380	33,507	14,669,968	210	0.0842	5.4	1,488
State Alternative	8,011	3,483	1,184	18,615	7,314,801	104	0.042	2.7	744
State Alternative % Reduction	62%	67%	50%	44%	50%	50%	50%	50%	50%
NMED SIP	16,100	10,500	2,380	33,507	14,699,968	210	0.0842	5.4	1,488
NMED SIP % Reduction	23%	0%	0%	0%	0%	0%	0%	0%	0%
EPA FIP	3,502	10,500	2,380	33,507	14,699,968	210	0.0842	5.4	1,488
EPA FIP % Reduction	83%	0%	0%	0%	0%	0%	0%	0%	0%

Visibility improvements were compared for the current configuration (Baseline), NMED SIP assessment (SNCR on all four units), the EPA FIP final determination (SCR on all four units), and the State Alternative Plan. Figure 10-2 shows the differences in visibility between the alternatives at the 16 Class I areas within 300 kilometers of SJGS. The State Alternative Plan provides similar visibility improvement as the EPA FIP plan. See Appendix D for additional details.

Figure 10-2: Comparison of Visibility Improvement of Alternatives at San Juan Generating Station



Note: WHPE – Wheeler Peak Wilderness Area, NM; WEMI – Weminuche Wilderness Area, CO; WEEL – West Elk Wilderness Area, CO; San Pedro Parks Wilderness Area – NM; PEFO – Petrified Forest National Park, AZ; PECO – Pecos Wilderness Area, NM; MEVE – Mesa Verde National Park, CO; MABE – Maroon Bells Wilderness Area, CO; LAGA – La Garita Wilderness Area, CO; GRSA – Great Sand Dunes National Monument, CO; GRCA – Grand Canyon National Park, AZ; CARE – Capitol Reef National Park, UT; CANY – Canyonlands National Park, UT; BLCA – Black Canyon of the Gunnison National Park, CO; BAND – Bandelier Wilderness Area, NM; ARCH – Arches National Park, UT

Based on this analysis, the Department determines that the State Alternative is superior to the 2011 NO_x BART SIP and EPA's NO_x BART FIP for the following reasons:

- 1) PNM will obtain the necessary construction permit modification to limit the SO₂ emission rates at Units 1 and 4 to 0.10 lb/MMBtu on a daily rolling 30-day average basis.
- 2) The retirement of Units 2 and 3 will reduce the facility annual NO_x emissions by an additional 10,550 tons. When added to the controlled emission rate of Units 1 and 4, total annual NO_x emission will be reduced by 12,989 tons. Additionally, PNM will conduct performance testing to determine if the SNCRs installed on Units 1 and 4 can achieve significantly less than 0.23 lb/MMBtu.
- 3) The retirement of Units 2 and 3 will reduce raw material usage at the facility, including limestone, activated carbon, coal and No. 2 diesel oil. See Table below.

Raw Material	State Alternative Plan (TPY)	Baseline, FIP, and FIP
Limestone ⁽¹⁾	86,052	172,104
Activated Carbon ⁽¹⁾	130	261
Coal ⁽²⁾	2,667,364	5,334,729
No. 2 Diesel Oil ⁽²⁾	1,007,336	2,014,671

- 4) The two-unit retirement scenario will result in a substantial decrease in particulate matter emissions from coal processing, handling and transportation, as well as a substantial reduction in greenhouse gas emissions, mercury and non-mercury emissions, and acid gas emissions as detailed in Table 22.
- 5) Water usage is expected to drop by up to approximately 53% to 10,161 acre-feet/year.
- 6) The visibility improvement from the State Alternative scenario achieves significant visibility improvements as compared to the baseline and the SNCR installation on Units 1-4. The visibility improvements from the two-unit retirement and 2 SNCR installation scenario compared very closely with the SCR installation scenario as proposed in the FIP (less than 0.5 dv impact).
- 7) The total capital investment of the proposed FIP is estimated at nearly \$861,871,000, as compared to \$34,556,000 for the installation of SNCR at Units 1 and 4. This additional and significant capital expenditure that would be required to comply with the FIP is not justified given the slight and undetectable improvement in visibility.

Accordingly, the State Alternative is hereby adopted in lieu of the 2011 NOx BART determination, to be implemented as provided in section 10.5 below.

10.5 Implementation of the State Alternative

In accordance with the Term Sheet, the following requirements apply to the San Juan Generating Station

- a. Fifteen (15) months after EPA final approval of this revised SIP, no earlier than January 31, 2016, Public Service Company of New Mexico (PNM) will complete installation of selective non-catalytic reduction (SNCR) technology on SJGS Unit 1 and 4 of no greater than 0.23 lb/MMBtu on a daily rolling 30-day average basis.
- b. Testing Program. PNM shall comply with the following. Dates that follow with an asterisk(*) in items (i) – (iv) shall be revised accordingly if the installation date extends past January 31, 2016 due to delay in EPA's SIP approval:
 - i. PNM will commence a program of testing and evaluation, after the installation of the SNCRs. The Testing Program consisting of SNCR Performance Testing, Fuel Performance Testing, and Long-Term Performance Evaluation is to be completed no later than January 31, 2017,* unless the Long-Term Performance Evaluation is delayed per the language in paragraph b.iv below.

- ii. SNCR Performance Testing will be conducted to develop a targeted ammonia/urea injection rate range at various load levels without exceeding a to-be-agreed-upon preliminary slip limit of between 5 and 10 ppm, with the goal of minimizing NOx emissions. PNM shall provide the results of the performance tests, recommended final slip limit, and target ammonia/urea injection rates to NMED and EPA by April 1, 2016.* PNM will allow up to April 30, 2016* for the agencies to either concur with PNM's slip limit recommendation or to concur on a different slip limit that PNM will comply with for Units 1 and 4.
- iii. PNM will conduct Fuel Performance Testing (in conjunction with the SNCR Performance Testing) of its pre-treated coal technology, so long as it has not been previously determined to result in any detrimental effect to SJGS Units 1 and 4 or their operation, with the objective of further reducing NOx emissions. If the Fuel Performance Testing demonstrates that it does not: (i) measurably increase NOx emissions, or (ii) adversely impact overall unit operations, PNM shall also use such pre-treated coal for the 9-month Long-Term Performance Evaluation Period described below. PNM will also use pre-treated coal on units 2 and 3 when used on units 1 and 4.
- iv. Long-Term Performance Evaluation Period. PNM will begin collecting NOx emission and ammonia/urea injection rate data from Units 1 and 4 on a daily rolling 30-day average basis for nine continuous months beginning on May 1, 2016* and provide such data and any recommendations on the NOx emission limit to NMED and EPA by February 28, 2017* or no later than 28 days after completing the Long-Term Performance Evaluation Period. PNM may request more time if a slip limit is not agreed upon by April 30, 2016.* The Long-Term Performance Evaluation Period must include 60 days between June 1st and August 30th and 60 days between December 1st and February 28th. The Demonstrated Emission Rate will be the highest daily rolling 30-day average emission rate during the 9-month Long-Term Performance Evaluation Period (not including periods of malfunction or abnormal operating conditions) adjusted to three significant digits. If the Demonstrated Emission Rate is greater than or equal to 0.200 lb/MMBtu on a daily rolling 30-day average basis no adjustment to the NOx emission rate for units 1 and 4 will be made. If the Demonstrated Emission Rate is less than 0.200 lb/MMBtu on a daily rolling 30-day average basis PNM will apply for a permit modification by March 31, 2017* (or no later than 60 days after completing the Long-Term Performance Evaluation Period) to reduce the permitted emission rate by 60% of the difference between 0.23 lb/MMBtu and the Demonstrated Emission Rate, provided the revised emission rate does not adversely impact overall unit operations. The permit modification will include the agreed upon ammonia slip limit.

- c. No later than six months from the Board's adoption this SIP revision, PNM will comply with a sulfur dioxide ("SO₂") emission rates at Units 1 and 4 of 0.10 lb/MMBtu on a daily rolling 30-day average basis.
- d. PNM shall diligently seek all necessary regulatory approvals to allow for retirement of SJGS Units 2 and 3 by December 31, 2017, and if such approvals are granted, shall retire SJGS Units 2 and 3 by December 31, 2017.
- e. Nothing in this SIP shall relieve the SJGS from its obligations to comply with all applicable federal, state, and local laws and regulations, including laws, regulations, and compliance deadlines that become applicable after the date that this SIP revision is approved by EPA.

**New Mexico Environment Department
Air Quality Bureau
Revised BART Determination**

**Public Service Company of New Mexico
San Juan Generating Station, Units 1-4**

**APPENDIX D
TO NEW MEXICO'S REGIONAL HAZE SIP
UNDER 40 C.F.R. 51.309(g)**

May 21, 2013

PREFACE

This document is a revised version of the BART Determination for Public Service Company of New Mexico (PNM) San Juan Generating Station Units 1-4 that was attached as Appendix D to New Mexico's June 2011 Regional Haze SIP, submitted pursuant to 40 CFR § 51.309(g). As explained within, it has been revised to incorporate new information submitted by PNM in April 2013. The new information was submitted in accordance with the terms of tentative settlement agreement between NMED, EPA, and PNM to resolve a dispute over the determination of BART for Nitrogen Oxides (NO_x) for the San Juan Generating Station.

Regulatory Background and Introduction:

In 1999, the EPA published a final rule to address a type of visibility impairment known as regional haze (64 FR 35714, July 1, 1999). This rule requires States to submit state implementation plans (SIPs) to address regional haze visibility impairment in 156 Federally-protected parks and wilderness areas. The 1999 rule was issued to fulfill a long-standing EPA commitment to address regional haze under the authority and requirements of sections 169A and 169B of the Clean Air Act (CAA).¹

As required by the CAA, the EPA included in the final regional haze rule a requirement for Best Available Retrofit Technology (BART) for certain large stationary sources. The regulatory requirements for BART were codified at 40 CFR 50.308(e) and in definitions that appear in 40 CFR 50.301.

The BART-eligible sources are those sources which (1) have the potential to emit 250 tons per year or more of a visibility impairing air pollutant; (2) were put in place between August 7, 1962 and August 7, 1977; and (3) whose operations fall within one or more of 26 specifically listed source categories. Under the CAA, BART is required for any BART-eligible source which a State determines “emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any such area.” Accordingly, for stationary sources meeting these criteria, States must address the BART requirement when they develop their regional haze SIPs.¹

The EPA published a second Regional Haze rulemaking on June 6, 2005 that made changes to the Final Rule published July 1, 1999. This second rulemaking was in response to a U.S. District Court of Appeals ruling that vacated part of the regional haze rule. The June 6, 2005 Final Rule (1) required the BART analysis to include an analysis of the degree of visibility improvement resulting from the use of control technology at BART-subject sources; (2) revised certain other BART provisions; (3) included new BART Guidelines contained in a new Appendix Y to Part 51 (Guidelines); and (4) added the requirement that States use the Guidelines for determining BART at certain large electrical generating units (EGUs).¹

The Guidelines also contained specific presumptive limits for SO₂ and NO_x for certain large EGUs based on fuel type, unit size, cost effectiveness, and presence or absence of pre-existing controls. For NO_x emissions, the EPA directs states to generally require owners and operators to meet the presumptive limits at coal-fired EGUs greater than 200 MW with a total facility-wide generating capacity greater than 750 MW. The presumptive limits for NO_x are based on coal type, boiler type and whether SCR or SNCR are already installed at the source.

Analysis of BART Eligible Sources in NM:

In May 2006, the New Mexico Environment Department, Air Quality Bureau (Department) conducted an internal review of sources potentially subject to the BART rule.

Section II of the Guidelines prescribes how to identify BART-eligible sources. States are required to identify those sources that satisfy the following criteria: (1) sources that fall within the 26 listed source categories as listed in the CAA; (2) sources that were “in existence” on August 7, 1977 but were not “in operation” before August 7, 1962; and (3) sources that have a current potential to emit that is greater than 250 tons per year of any single visibility impairing pollutant. New Mexico identified 11 sources as BART-eligible sources as part of this review.²

The Guidelines then prescribe to the states how to identify those sources that are subject to BART. At this point, states are directed to either (1) make BART determinations for all BART-eligible sources, or (2) to consider exempting some of the sources from BART because they may not reasonably be anticipated to cause or contribute to any visibility impairment in a Class I area. New Mexico opted to perform an initial screening model on each of these BART-eligible sources to determine whether each source did cause or contribute to any visibility impairment. The Guidelines direct States that if the analysis shows that an individual source or group of sources is not reasonably anticipated to cause or contribute to any visibility impairment in a Class I area, then the States do not need to make a BART determination for that source or group of sources.¹ The guidelines provide that the threshold for determining whether a source “contributes” to visibility impairment should be set no higher than 0.5 deciview (dv).

The Western Regional Air Partnership (WRAP) performed the initial BART modeling for the state of New Mexico. The procedures used are outlined in the WRAP Regional Modeling Center (RMC) BART Modeling Protocol that is available at:

http://pah.cert.ucr.edu/aqm/308/bart/WRAP_RMC_BART_Protocol_Aug15_2006.pdf

The basic assumptions in the WRAP BART CALMET/CALPUFF modeling used for New Mexico are as follows:

- i. Use of three years of modeling of 2001, 2002, and 2003.
- ii. Visibility impacts due to emissions of SO₂, NO_x and primary PM emissions were calculated. PM emissions were modeled as PM_{2.5}.
- iii. Visibility was calculated using the Original IMPROVE equation and Annual Average Natural Conditions.

Initial modeling was performed for the 11 source complexes in New Mexico to assess visibility impacts from SO₂, NO_x, and PM emissions.

Of the 11 source complexes analyzed, only one source complex’s visibility impacts at any Class I area due to combined SO₂, NO_x, and PM emissions exceeded the 0.5 dv threshold. This source was PNM San Juan Generating Station, Boilers #1-4 (“SJGS”). Of the 10 other source complexes, none exceed a 0.33 dv impact. Therefore, for the SJGS only, the separate contribution to visibility at Class I areas was assessed for SO₂ alone (SO₄), NO_x alone (NO₃), PM alone (PMF), and combined NO_x plus PM emissions (NO₃ + PMF).²

On November 9, 2006, the Department informed PNM that the modeling performed by the WRAP indicated the visibility impairment from the SJGS was over the 0.5 dv threshold, and SJGS was therefore subject to a BART analysis. In response, Black & Veatch (B&V), on behalf of PNM, submitted the BART Modeling Protocol document which described the CALPUFF modeling methodology to be used as part of the BART engineering evaluation for SJGS.

SJGS Source Description:

The SJGS consists of four coal-fired generating units and associated support facilities. Each coal-fired unit burns pulverized coal and No. 2 diesel oil (for startup) in a boiler and produces high-pressure steam, which powers a steam turbine coupled with an electric generator. Electric power produced by the units is

supplied to the electric power grid for sale. Coal for the units is supplied by the adjacent San Juan Mine and is delivered to the facility by conveyor.

The SJGS Boiler Units 1 and 2 have a unit capacity of 350 and 360 MW, respectively. The units are equipped with Foster Wheeler subcritical, wall-fired boilers that operate in a forced draft mode. The SJGS Boiler Units 3 and 4 each have a unit capacity of 544 MW and are equipped with B&W subcritical, opposed wall-fired boilers that operate in a forced draft mode.

Consent Decree:

On March 5, 2005, PNM entered into a consent decree with the Grand Canyon Trust, the Sierra Club, and the Department to settle alleged violations of the CAA. The consent decree required PNM to meet a PM average emission rate of 0.015 pounds per million British thermal units (lb/MMBtu) (measured using EPA Reference Method 5), and a 0.30 lb/MMBtu emission rate for NO_x (daily rolling, thirty day average), for each of Units 1, 2, 3, and 4. As a result, PNM installed Low NO_x burners (LNB) with overfire air (OFA) ports and a neural network (NN) system to reduce NO_x emissions, and pulse jet fabric filters (PJFF) to reduce the PM emissions (See Table 1).

Table.1: SJGS Characteristics

SJGS Characteristics				
Unit	SJGS 1	SJGS 2	SJGS 3	SJGS 4
Fuel Type	Sub-bituminous	Sub-bituminous	Sub-bituminous	Sub-bituminous
HHV of Fuel (btu/lb)	9692	9692	9692	9692
Unit Rating, MW (gross)	360	350	544	544
Boiler Heat Input (Mbtu/hr)	3707	3688	5758	5649
Type of Boiler	Wall-fired	Wall-fired	Opposed Wall-fired	Opposed Wall-fired
Steam Cycle	Subcritical	Subcritical	Subcritical	Subcritical
Draft of Boiler	Forced	Forced	Forced	Forced
Existing Emissions Controls				
PM	PJFF	PJFF	PJFF	PJFF
SO₂	Wet FGD	Wet FGD	Wet FGD	Wet FGD
NO_x	LNB/OFA/NN	LNB/OFA/NN	LNB/OFA/NN	LNB/OFA/NN

BART Analysis Overview:

Per 40 CFR 51.308 *Regional haze program requirements*, the determination of BART must be based on an analysis of the best system of continuous emission control technology available and associated emission reductions achievable for each BART-eligible source that is subject to BART within the State. In this analysis, the State must take into consideration each available technology, the associated costs of compliance of each, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.¹

The determination of BART for fossil-fuel power plants having a total generating capacity in excess of 750 megawatts must be made pursuant to the Guidelines.¹

PNM's BART Analysis for NOx and PM:

PNM submitted a BART analysis for the SJGS to the Department on June 6, 2007. The BART analysis was performed in two stages. First, a BART analysis was performed for the consent decree technologies being implemented at the SJGS. In the second stage, additional control technology alternatives to the consent decree technologies were identified and evaluated. To determine the visibility improvements from both the consent decree technology upgrades and additional control technology, the Department determined it was appropriate to review both pre-consent decree to consent decree visibility improvement and improvement projected from the consent decree plus additional control technologies.

Per Appendix Y to 40 CFR Part 51 – Guidelines, PNM followed the 5 Step Process in the SJGS BART Analysis:

- Step 1 – Identify All Available Retrofit Control Technologies
- Step 2 – Eliminate Technically Infeasible Options
- Step 3 – Evaluate Control Effectiveness of Remaining Control Technologies
- Step 4 – Evaluate Impacts and Document the Results
 - a) Costs of Compliance
 - b) Energy Impacts
 - c) Air quality environmental impacts
 - d) Non-air environmental impacts
 - e) Remaining useful life
- Step 5 – Evaluate Visibility Impacts

In response to the Department's requests, PNM submitted multiple amendments to the original June 2007 BART Analysis application. What follows is a summary of the original and additional submittals:

June 6, 2007

The original BART analysis application included a five factor analysis of NOx technology. Modeling analyses were performed to provide SJGS plant-wide regional haze visibility impacts at 16 Class I areas. These analyses were based on a constant 1 ppb background ammonia concentration and no nitrate repartitioning. The NOx control technologies analyzed were the Selective Catalytic Reduction (SCR) and SNCR/SCR Hybrid.³

November 6, 2007

Modeling analyses were performed to provide SJGS plant-wide regional haze visibility impacts at 16 Class I areas. The analysis was based on refinements which included using the nitrate repartitioning methodology and monthly variable background ammonia concentrations. Again, the NOx control technologies analyzed were the SCR and SNCR/SCR Hybrid.³

March 29, 2008

PNM submitted an additional discussion of cost estimation methods used to determine costs of SCR installation and a discussion of Nalco Mobotec ROFA and Rotamix technology.³

March 31, 2008

Two modeling analyses were performed to provide SJGS plant-wide and unit specific regional haze visibility impacts at 16 Class I areas for the SCR NO_x control technology only. One of the analyses, believed by PNM to be the more representative of ammonia chemistry of the area, was based on the November 6, 2007 refinements which included using nitrate repartitioning methodology and monthly variable background ammonia concentrations. The other analysis included nitrate repartitioning and a constant background ammonia concentration as requested by the Department.³

May 30, 2008

Two modeling analyses were performed to provide SJGS plant-wide and unit specific regional haze visibility impacts at 16 Class I areas for the SNCR NO_x control technology only. Similar to the March 31, 2008 analyses, one of the analyses was based on the November 6, 2007 refinements which included using nitrate repartitioning methodology and monthly variable background ammonia concentrations. The other analysis used nitrate repartitioning methodology and constant background ammonia concentration. It should be noted that PNM modeled all variants of SNCR together (including Fuel Tech and Nalco Mobotec) as one technology called SNCR. This is the same approach that is used for modeling SCR control technology, where all variants are modeled generically as SCR.³

At the request of the Department, PNM and B&V also provided a five-factor BART analysis for SNCR technology and a discussion of coal characteristics of the coal burned at the SJGS.

August 29, 2008

Three modeling analyses were performed to provide SJGS plant-wide and unit specific regional haze visibility impacts at 16 Class I areas for the ROFA with Rotamix, Rotamix, ROFA, and WESP PM control technologies (the NO_x and PM analyses were submitted separately). Similar to the May 30, 2008 analyses, these analyses were also based on the November 6, 2007 refinements, which included using the nitrate repartitioning methodology and monthly variable background ammonia concentrations.³

At the request of the Department, PNM and B&V also provided a five-factor BART analysis of Nalco Mobotec control technology, including ROFA, Rotamix and ROFA/Rotamix and a five-factor BART analysis of additional PM control technology.³

March 16, 2009

Four modeling analyses were performed to provide SJGS plant-wide and unit specific regional haze visibility impacts at 16 Class I areas. These include SCR technology, SCR/SNCR Hybrid technology, SCR technology with sorbent injection, and SCR/SNCR Hybrid technology with sorbent injection. As requested by the Department, for each of these cases, the modeling also took into consideration inherent SO₃ removal of the SO₃ formed from the catalyst oxidation of SO₂ to SO₃.³

February 15, 2011

A revised analysis of SNCR technology was submitted after PNM received a lower vendor-guaranteed emission rate from Fuel Tech, a vendor of SNCR technology. The analysis also included updated cost estimates for SCR, SNCR/SCR Hybrid, ROFA/Rotamix, Rotamix (SNCR), ROFA, and SNCR (Fuel Tech) technologies.

The submittal further included a ratepayer impact analysis which estimated the cost impact to residential ratepayers from installation of SNCR and SCR technologies.

One modeling analysis was performed to provide SJGS plant-wide and unit specific regional haze visibility impacts at 16 Class I areas assuming the revised SNCR control technology on all four units.³

April 1, 2013

This submittal compares new information as contained in a non-binding term sheet signed by the EPA, NMED and PNM on February 15, 2013. This update considers the emissions reductions and economic analysis of three specific control scenarios at SJGS, as contained in the EPA's Federal Implementation Plan, issued August 22, 2011; the State of New Mexico's State Implementation Plan, approved by the State Environmental Improvement Board on June 2, 2011; and an alternative entitled the State Alternative Plan, which considers the voluntary retirement of Units 2 and 3.

An updated cost analysis of installing SCR control on all four units, SNCR control on all four units, and installing SNCR on Units 1 and 4 was prepared by Sargent & Lundy (S&L) at the request of PNM. This analysis reflected the approach described in the EPA's Control Cost Manual.

An updated visibility analysis based on the installation of SCR on all four units, SNCR on all four units, and SNCR on Units 1 and 4 and a two-unit shut down scenario was also submitted. This analysis is included in addition to the previous modeling analysis and is presented as the Updated Visibility Modeling Assessment Submitted April 1, 2013 of Step 5 of this document.

The updated visibility analysis for the installation of SCR on all four units and SNCR on all four units incorporated the SO₂ and total particulate matter (TPM) emission rates of 0.15 lb/MMBtu and 0.034 lb/MMBtu, respectively, from the current NSR Permit issued August 31, 2012. The updated visibility analysis for the installation of SNCR on Units 1 and 4 and a two-unit retirement incorporated the new TPM emission rate of 0.034 lb/MMBtu and an SO₂ emission rate of 0.10 lb/MMBtu. This new SO₂ emission rate will be incorporated into the facility's NSR Permit as a federally-enforceable permit condition should this scenario be determined as BART for the source.

Step 1 of the BART Analysis: Identification of All Available Retrofit Emissions Control Technologies

NOx Control Technologies

The main strategies for reducing NOx emissions take two forms: 1) modification to the combustion process to control fuel and air mixing and reduce flame temperatures, and 2) post-combustion treatment of the flue gas to remove NOx. PNM and B&V identified the following available NOx control technologies and a discussion of each of the technologies:

1) Low NOx Burners, Overfire Air, and Neural Network

Low NOx burners slow and control the rate of fuel and air mixing, thereby reducing the oxygen availability in the ignition and main combustion zones. Overfire Air uses low excess air levels in the primary combustion zone with the remaining (overfire) air added higher in the furnace to complete combustion. Neural Network provides improvements in the heat rate and reduces combustion-related emissions by fine-tuning the combustion process.³

2) Selective Non Catalytic Reduction (SNCR)

SNCR is based on the chemical reduction of the NO molecule into molecular nitrogen and water vapor. A nitrogen based reducing agent (reagent), such as ammonia or urea, is injected into the post combustion flue gas. The reduction with NO is favored over other chemical reaction processes at temperatures ranging between 1600F and 2100F (870C to 1150C), therefore, it is considered a selective chemical process.⁴

3) Selective Catalytic Reduction (SCR)

The SCR process chemically reduces the NO molecule into molecular nitrogen and water vapor in the presence of a reducing catalyst. A nitrogen based reducing reagent such as ammonia or urea is injected into the ductwork, downstream of the combustion unit. The waste gas mixes with the reagent and enters a reactor module containing catalyst. The hot flue gas and reagent diffuse through the catalyst. The reagent reacts selectively with the NO within a specific temperature range and in the presence of the catalyst and excess oxygen.⁵

Sorbent injection removes SO₃ in the flue gas by reaction of the SO₃ with an alkaline sorbent material to form a particulate that is subsequently removed in a particulate control device. The alkaline material injected can be a magnesium, sodium, or calcium-based sorbent. The injection points for the reagents may vary. For this analysis, hydrated lime was selected.⁴

4) SNCR/SCR Hybrid

The SNCR/SCR hybrid systems use components and operating characteristics of both SNCR and SCR systems. Hybrid systems were developed to combine the low capital cost and high ammonia slip associated with SNCR systems with the high reduction potential and low ammonia slip inherent in the catalyst of SCR systems.³

SNCR/SCR Hybrid plus Sorbent Injection

Sorbent injection removes SO₃ in the flue gas by reaction of the SO₃ with an alkaline sorbent material to form a particulate that is subsequently removed in a particulate control device. The alkaline material injected can be a magnesium, sodium, or calcium-based sorbent. The injection points for the reagents may vary. For this analysis, hydrated lime was selected.⁴

5) Gas Reburn

The gas reburn process combusts auxiliary natural gas, along with coal, in the boiler. Three separate combustion zones in the boiler are manipulated to reduce NO_x emissions.⁴

6) Nalco Mobotec ROFA and Rotamix

ROFA and Rotamix are proprietary control technologies developed by Nalco Mobotec. ROFA, or Rotating Opposed Firing Air, is a modified overfire air technology that utilizes rotation of flue gases and turbulent mixing to reduce NO_x emissions. Rotamix is a version of SNCR technology and operates under the same principles as other SNCR technology.³

7) NOxStar

NOxStar is the trademarked name for a NOx control technology that involves the injection of ammonia and a hydrocarbon (typically natural gas) into the flue gas path of a coal-fired boiler at around 1600F to 1800F for the reduction of NOx.³

8) ECOTUBE

The ECOTUBE system utilizes retractable lance tubes that penetrate the boiler above the primary combustion burner zone and inject high-velocity air as well as reagents. The lance tubes work to create turbulent airflow and to increase the residence time for the air/fuel mixture. In principle, the OFA and SNCR processes are combined in this technology.³

9) PowerSpan ECO

The PowerSpan ECO system is a multi-pollutant technology with limited experience. The PowerSpan ECO system is located downstream of an existing particulate control device and treats the power plant's flue gas in three process steps to achieve multi-pollutant removal of sulfur dioxide (SO₂), nitrogen oxides (NOx), oxidized mercury, and fine particulate matter.³

10) Phenix Clean Combustion

The Phenix Clean Combustion System is an advanced hybrid coal gasification/combustion process that prevents the formation of NOx and SO₂ emissions when burning coal.³

11) e-SCRUB

The e-SCRUB process is similar to the PowerSpan technology in that it uses an energy source to oxidize pollutants in the flue gas. However, there are some variations in the oxidation energy source and the byproduct recovery systems.

PM Control Technologies

Particulate matter emissions can only be controlled by post-combustion control technologies. PNM identified the following technologies as available in their BART analysis for PM.

1) Flue Gas Conditioning with Hot-Side ESP

Flue gas conditioning improves the collection efficiency of particulate matter in the ESP. Flue gas leaving the air heater into the ESP can be conditioned by addition of ionic compounds, such as SO₃ or ammonia. These compounds combine with the moisture in the flue gas and are deposited on the surface of the fly ash particles. This will increase the conductivity of the fly ash and make it more suitable for capture.³

2) Pulse Jet Fabric Filter (PJFF)

In PJFFs, the flue gas typically enters the compartment hopper and passes from the outside of the bag to the inside of the bag, depositing particulate on the outside of the bag. To prevent collapse of the bag, a metal cage is installed on the inside of the bag. The flue gas passes up through the

center of the bag into the output plenum. Cleaning is performed by initiating a downward pulse of air into the top of the bag. The pulse causes a ripple effect along the length of the bag. This releases the dust cake from the bag's exterior surface, allowing the dust to fall into the hopper.³

3) Compact Hybrid Particulate Collector

A variant of the PJFF is the compact hybrid particulate collector. This is a high air to cloth (A/C) ratio fabric filter installed downstream of existing particulate collection devices where the majority of PM has been removed.³

4) Max-9 Electrostatic Fabric Filter

The Max-9 filter is essentially a high-efficiency PJFF utilizing a discharge electrode as in an ESP. However, there are no collector plates. When the dust particles are charged, they are attracted to the grounded metal cage inside the filter element, just as they would be attracted to the collecting plates in an ordinary precipitator.³

Step 2 of the BART Analysis: Eliminate Technically Infeasible Control Technologies

NOx Control Technologies

PNM excluded several of the identified NOx controls due to technical infeasibility. In the BART analysis application, PNM excluded the following NOx control technologies:

1) Selective Non-Catalytic Reduction

PNM determined in its submittal of June 6, 2007 that SNCR technology was technically infeasible because the technology was unable to meet the presumptive limits for NOx; determined by EPA to be 0.23 lb NOx/MMBtu for dry bottom, wall-fired boilers burning sub-bituminous coal. A vendor estimated that the technology could only achieve 0.24 lb NOx/MMBtu. In order for the technology to achieve the presumptive limit, PNM stated that ammonia slip limit would need to be raised from 5 ppm to 10 ppm, and that this higher ammonia slip posed additional operational problems.

The Department did not agree with PNM's argument that because SNCR could not meet the presumptive limits the technology should be eliminated as technically infeasible. Therefore the Department requested PNM to perform the complete 5-factor BART analysis required by the Guidelines on SNCR. PNM submitted the five-factor analysis of SNCR in a subsequent submittal dated May 30, 2008, an updated analysis of Fuel Tech's SNCR on February 11, 2011, and an additional updated analysis on April 1, 2013.

2) Natural Gas Reburn

PNM determined that the current boiler space inhibits sufficient residence time for the natural gas reburn zone. The Department accepts PNM's elimination of this technology due to space limitations.

3) Nalco Mobotec ROFA and Rotamix

PNM determined the Rotamix technology was technically infeasible due to limited application at coal-fired boilers equivalent to the size of Units 1-4 at SJGS. PNM determined ROFA technology was technically infeasible because ROFA is a variant of OFA, which at the time was being installed at Units 1-4 at SJGS.

The Department did not agree with PNM's position that Rotamix has limited application at coal-fired boilers equivalent to the size of Units 1-4 at SJGS. The Department did not agree that because ROFA is a variant of OFA, the technology can be eliminated as technically infeasible. Therefore, the Department requested PNM perform the complete 5-factor analysis for ROFA and Rotamix. PNM performed the analysis and submitted the analysis in two subsequent submittals dated March 29, 2008 and August 29, 2008.

4) NOxStar

NOxStar currently has only one major installation in the US. In addition, PNM stated that in recent discussions the supplier has identified limited ability and willingness to market the commercial technology. The Department agrees that this technology has limited application to large coal-fired boilers and is not technically feasible.

5) ECOTUBE

The ECOTUBE technology has been demonstrated on industrial/small boilers firing solid waste, wood, and biomass.³ ECOTUBE has limited application to boilers similar to Units 1-4 at the SJGS. The Department agrees that this technology has limited application to large coal-fired boilers and is not technically feasible.

6) PowerSpan

PowerSpan has not been demonstrated on large boilers, such as Units 1-4 at SJGS. The Department agrees that this technology has limited application to large coal-fired boilers and is not technically feasible.

7) Phenix Clean Combustion

PNM determined that the Phenix Clean Combustion system is still in the demonstration and testing stage and there are no commercial retrofits at facilities similar to SJGS. The Department agrees that this technology has no demonstrated application to the source type and is not technically feasible.

8) e-SCRUB

PNM determined that the e-SCRUB technology has only one known medium scale installation with limited data. The Department agrees that the technology should be considered technically infeasible due to limited demonstrated applications.

PM Control Technologies

PNM excluded the following PM control technologies as technically infeasible:

1) Flue Gas Conditioning with Hot-Side ESP

Flue gas conditioning does improve collection efficiencies, but will not achieve an emission limit lower than the current PM limit in their air quality permit. The Department agrees that flue gas conditioning control technology should not be considered in the BART analysis. Because the vendor was unable to guarantee a lower emission rate, the technology does not need to undergo the three additional factors of the five factor analysis.

2) Compact Hybrid Particulate Collector

The compact hybrid particulate collector does not provide a performance guarantee lower than the current permitted limit for PM. The Department agrees that the compact hybrid PM control technology should not be considered in the BART analysis. Because the vendor was unable to guarantee a lower emission rate, the technology does not need to undergo the three additional factors of the five factor analysis.

3) Max-9 Electrostatic Fabric Filter

The Max-9 electrostatic fabric filter has been installed in a small-sized utility boiler, but there are no commercial installations of a similar size to Units 1-4 at SJGS. The Department agrees that the limited application of this technology to large utility boilers justifies removing the technology as technically infeasible.

During the Department review of available PM control technologies, the Department requested PNM to perform a complete five-factor BART analysis on Wet Electrostatic Precipitator (WESP). The Department believes this technology should have been identified as technically feasible in Step 1 of the PM BART analysis. PNM performed a complete five-factor BART analysis on WESP and PJFF and submitted a report in a subsequent submittal dated August 28, 2008.

Step 3 of the BART Analysis: Evaluate Control Effectiveness of Remaining Control Technologies

PNM contracted with B&V and S&L to determine the control effectiveness of each remaining available NOx and PM control technology for Units 1-4. The control efficiencies of each of the NOx control technologies are summarized in Tables 2 – 5, and the control efficiencies of the PM control technologies are summarized in Tables 6 – 9.

Table 2: NO_x Control Effectiveness for Unit 1

Control Technology	Control Efficiency (%)	Baseline Emissions (tpy)	Emissions Reduction (tpy)	Controlled Emission Rate (lb/MMBtu)	Controlled Emission Rate (tpy)
Pre-Consent Decree (Pre-CD)	NA	NA	NA	0.43	5394
CD	23	5394	1254	0.30	4140
ROFA	13	4140	552	0.26	3588
Rotamix (SNCR)	23	4140	966	0.23	3174
SNCR	23	4140	966	0.23	3174
ROFA/Rotamix	33	4140	1380	0.20	2760
SCR/SNCR Hybrid	40	4140	1656	0.18	2484
SCR	83	4140	3450	0.05	690

Table 3: NO_x Control Effectiveness for Unit 2

Control Technology	Control Efficiency (%)	Baseline Emissions (tpy)	Emissions Reduction (tpy)	Controlled Emission Rate (lb/MMBtu)	Controlled Emission Rate (tpy)
Pre-Consent Decree (Pre-CD)	NA	NA	NA	0.45	6179
CD	33	6179	2060	0.30	4119
ROFA	13	4119	549	0.26	3570
Rotamix (SNCR)	23	4119	961	0.23	3158
SNCR	23	4119	961	0.23	3158
ROFA/Rotamix	33	4119	1373	0.20	2746
SCR/SNCR Hybrid	40	4119	1648	0.18	2471
SCR	83	4119	3432	0.05	687

Table 4: NO_x Control Effectiveness for Unit 3

Control Technology	Control Efficiency (%)	Baseline Emissions (tpy)	Emissions Reduction (tpy)	Controlled Emission Rate (lb/MMBtu)	Controlled Emission Rate (tpy)
Pre-Consent Decree (Pre-CD)	NA	NA	NA	0.42	9004
CD	29	9004	2573	0.30	6431
ROFA	13	6431	857	0.26	5574
Rotamix (SNCR)	23	6431	1500	0.23	4931
SNCR	23	6431	1500	0.23	4931
ROFA/Rotamix	33	6431	2144	0.20	4287
SCR/SNCR Hybrid	40	6431	2572	0.18	3859
SCR	83	6431	5359	0.05	1072

Table 5: NO_x Control Effectiveness for Unit 4

Control Technology	Control Efficiency (%)	Baseline Emissions (tpy)	Emissions Reduction (tpy)	Controlled Emission Rate (lb/MMBtu)	Controlled Emission Rate (tpy)
Pre-Consent Decree (Pre-CD)	NA	NA	NA	0.42	8833
CD	29	8833	2524	0.30	6309
ROFA	15	6309	841	0.26	5468
Rotamix (SNCR)	23	6309	1472	0.23	4837
SNCR	23	6309	1472	0.23	4837
ROFA/Rotamix	33	6309	2103	0.20	4206
SCR/SNCR Hybrid	40	6309	2524	0.18	3786
SCR	83	6309	5257	0.05	1052

Table 6: PM Control Effectiveness for Unit 1

Control Technology	Control Efficiency (%)	Baseline Emissions (tpy)	Emissions Reduction (tpy)	Controlled Emission Rate (lb/MMBtu)	Controlled Emission Rate (tpy)
Pre-Consent Decree (Pre-CD)	NA	NA	NA	0.050	690
PJFF (CD)	70	690	483	0.015	207
WESP	33	207	69	0.010	138

Table 7: PM Control Effectiveness for Unit 2

Control Technology	Control Efficiency (%)	Baseline Emissions (tpy)	Emissions Reduction (tpy)	Controlled Emission Rate (lb/MMBtu)	Controlled Emission Rate (tpy)
Pre-Consent Decree (Pre-CD)	NA	NA	NA	0.050	687
PJFF (CD)	70	687	481	0.015	206
WESP	33	206	69	0.010	137

Table 8: PM Control Effectiveness for Unit 3

Control Technology	Control Efficiency (%)	Baseline Emissions (tpy)	Emissions Reduction (tpy)	Controlled Emission Rate (lb/MMBtu)	Controlled Emission Rate (tpy)
Pre-Consent Decree (Pre-CD)	NA	NA	NA	0.050	1072
PJFF (CD)	70	1072	750	0.015	322
WESP	33	322	108	0.010	214

Table 9: PM Control Effectiveness for Unit 4

Control Technology	Control Efficiency (%)	Baseline Emissions (tpy)	Emissions Reduction (tpy)	Controlled Emission Rate (lb/MMBtu)	Controlled Emission Rate (tpy)
Pre-Consent Decree (Pre-CD)	NA	NA	NA	0.050	1052
PJFF (CD)	70	1052	737	0.015	315
WESP	33	315	105	0.010	210

Step 4 of the BART Analysis: Perform Impacts Analysis of Remaining Control Technologies

The Guidelines require states to consider four types of impact analysis in Step 4 of the BART analysis. These four types of impacts consider the costs of compliance, energy impacts, non-air quality environmental impacts, and remaining useful life of the facility. These impacts are included in the cost-effectiveness of each additional control technology and allow comparisons to be made between the remaining controls. B&V performed an impact analysis for the remaining NO_x and PM control technologies in accordance with the Guidelines.

B&V and S&L prepared the design parameters and developed estimates of capital and annual costs for applications of SCR, SNCR, SCR/SNCR Hybrid, ROFA, Rotamix, ROFA/Rotamix, PJFF, and WESP technologies. B&V relied on a number of sources to prepare the design parameters, including information from the Nalco Mobotec equipment vendors, SCR and SNCR equipment vendors, EPA cost manuals, engineering and performance data, and B&V's own in-house engineering estimates.

PNM evaluated the energy impacts, non-air quality environmental impacts, and remaining useful life of all additional technically feasible control options for NO_x and PM. Energy impacts from control equipment that consume auxiliary power during operation were considered for all control options. For SCR, SNCR and SCR/SNCR Hybrid technology, the non-air quality environmental impacts included the consideration of water usage and waste generated from each control technology. For WESP technology, PNM considered the auxiliary power consumption to operate the WESP and fans, and the additional water consumption and waste water disposal requirements from operating the WESP. Lastly, the remaining useful life was defined as 20 years. Therefore, no additional cost adjustments for a short remaining useful boiler life need to be considered. The results of the impact analyses for additional NO_x and PM control technologies are summarized in Tables 10 and 11 on the following pages.

Following the initial submittal, the Department made additional requests for information on the impact analysis for SCR, SNCR, ROFA, Rotamix and WESP, and for further consideration of inherent and additional control of SO₃ from both the SCR and SCR/SNCR Hybrid technology.

SCR Costs

The Department reviewed the original cost analysis for SCR technology and subsequently requested that PNM provide additional information on the basis of their cost analysis of SCR technology. In response to the request, B&V provided additional clarification for the cost analysis for SCR technology and submitted it to the Department on March 29, 2008. The submittal discussed how the OAQPS cost control manual is an insufficient method for determining actual costs of retrofitting the SJGS with SCR and provided a comparison between cost estimation based on the OAQPS manual and the B&V provided estimate.

In April, 2013, PNM submitted an updated cost analysis of SCR prepared by S&L. PNM contracted with S&L to prepare a conceptual design, project cost estimate and technical portions of an Engineer, Procurement, and Construction plan. S&L used budgetary quotes from equipment vendors for the major components and S&L's in-house database of equipment and material costs for similar projects. The capital cost estimates are stated in 2013 dollars.

Consideration of SO₃ Control

PNM's initial analysis of SCR and SCR/SNCR technology took into consideration additional oxidation of SO₂ to SO₃ across the SCR catalyst bed. The Department requested PNM to consider inherent removal of SO₃ emissions from existing air pollution control equipment, and removal of SO₃ emissions through installation of sorbent injection. PNM responded with an amended submittal addressing both inherent

and add-on removal of SO_3 . PNM's submittal provided cost estimates of the sorbent injection system and updated visibility modeling for both SCR and SCR/SNCR Hybrid technologies.

The Department understands that there are SCR catalysts now on the market that are capable of a much smaller SO_2 to SO_3 conversion (around 0.5%) as opposed to the assumed 1%. The Department believes use of such a catalyst will minimize SO_3 oxidation to less than what was represented in PNM's analysis.

SNCR, WESP, ROFA, and Rotamix Review

PNM provided additional impact analyses of SNCR, WESP, ROFA, and Rotamix technologies and submitted those updates to the Department. Please refer to the Chronology of Submissions located earlier in this document for an overview of the specific updates to these technologies.

Table 10: Impact Analysis and Cost Effectiveness of Additional NOx Control Technologies

Control Technology	Emission Performance Level (lb/MMBtu)	Expected Emission Rate (tpy)	Expected Emission Reduction (tpy)	Total Capital Investment (TCI) (1,000\$)	Total Annualized Cost (TAC) (1,000\$)	Cost Effectiveness (\$/ton)	Incremental Cost Effectiveness (\$/ton)	Energy Impacts (1,000\$)	Non-Air Impacts (1,000\$)
Unit 1									
SCR + sorbent (FIP)	0.05	690	3,450	180,862	22,165	6,425	6,749	746	NA ¹
SNCR/SCR Hybrid	0.18	2,484	1,656	110,683	16,816	10,154	35,917	706	1,762
ROFA/Rotamix	0.20	2,760	1,380	30,790	6,902	5,001	7,982	1,413	3
Rotamix (SNCR)	0.23	3,174	966	11,822	3,597	3,723	116	51	4
SNCR	0.23	3,174	966	17,392	5,400	5,590	80	43	NA ¹
ROFA	0.26	3,588	552	19,256	3,549	6,429	--	1,363	NA ¹
Consent Decree	0.30	4,140	1,254	14,580	1,422	1,134	NA	NA ¹	NA ¹
Pre-CD	0.43	5,394	NA	NA	NA	NA	NA	NA	NA ¹
Unit 2									
SCR + sorbent (FIP)	0.05	687	3,433	203,360	24,562	7,157	7,755	729	NA ¹
SNCR/SCR Hybrid	0.18	2,471	1,648	115,151	17,306	10,503	37,887	346	1,762
ROFA/Rotamix	0.20	2,746	1,373	30,790	6,902	5,027	8,024	1,413	3
Rotamix (SNCR)	0.23	3,158	961	11,822	3,597	3,742	117	51	4
SNCR	0.23	3,158	961	17,392	5,400	5,618	80	43	NA ¹
ROFA	0.26	3,570	549	19,256	3,549	6,462	--	1,363	NA ¹
Consent Decree	0.30	4,119	2,060	14,126	1,378	669	NA	NA ¹	NA ¹
Pre-CD	0.45	6,179	NA	NA	NA	NA	NA	NA	NA ¹
Unit 3									
SCR + sorbent (FIP)	0.05	1,072	5,359	264,208	32,585	6,080	6,313	1,107	NA ¹
SNCR/SCR Hybrid	0.18	3,859	2,572	178,759	26,604	10,342	39,171	507	2,658
ROFA/Rotamix	0.20	4,287	2,144	35,724	9,810	4,576	7,498	2,810	5
Rotamix (SNCR)	0.23	4,931	1,501	13,919	4,988	3,324	-378	84	5
SNCR	0.23	4,931	1,501	17,163	8,224	5,480	-578	51	NA ¹
ROFA	0.26	5,574	857	22,081	5,231	6,100	--	2,725	NA ¹
Consent Decree	0.30	6,431	2,573	12,715	1,240	482	NA	NA ¹	NA ¹
Pre-CD	0.42	9,004	NA	NA	NA	NA	NA	NA	NA ¹
Unit 4									
SCR + sorbent (FIP)	0.05	1,052	5,257	235,940	29,508	5,613	5,623	1,102	NA ¹
SNCR/SCR Hybrid	0.18	3,786	2,524	171,412	25,808	10,226	38,034	507	2,658
ROFA/Rotamix	0.20	4,206	2,103	35,724	9,810	4,664	7,643	2,810	5
Rotamix (SNCR)	0.23	4,837	1,472	13,919	4,988	3,388	-385	84	5
SNCR	0.23	4,837	1,472	17,163	8,224	5,587	-590	51	NA ¹
ROFA	0.26	5,468	841	22,081	5,231	6,218	--	2,725	NA ¹
Consent Decree	0.30	6,309	2,524	12,870	1,256	498	NA	NA ¹	NA ¹
Pre-CD	0.42	8,833	NA	NA	NA	NA	NA	NA	NA ¹

Table 11: Impact Analysis and Cost Effectiveness of Additional PM Control Technologies

Control Technology	Emission Performance Level (lb/MMBtu)	Expected Emission Rate (tpy)	Expected Emission Reduction (tpy)	Total Capital Investment (TCI) (1,000\$)	Total Annualized Cost (TAC) (1,000\$)	Incremental Cost Effectiveness (\$/ton)	Cost Effectiveness (\$/ton)	Energy Impacts (1,000\$)	Non-Air Impacts (1,000\$)
Unit 1									
WESP	0.010	138	69	99,308	11,855	20,696	171,812	1,112	NA ¹
PJFF (CD)	0.015	207	483	67,072	10,427	NA	21,588	4,488	NA ¹
Pre-CD	0.050	690	NA	NA	NA	NA	NA	NA	NA
Unit 2									
WESP	0.010	137	70	99,663	11,895	16,157	169,929	1,112	NA ¹
PJFF (CD)	0.015	207	480	69,840	10,764	NA	22,425	4,488	NA ¹
Pre-CD	0.050	687	NA	NA	NA	NA	NA	NA	NA
Unit 3									
WESP	0.010	214	108	129,565	15,558	28,741	144,056	1,728	NA ¹
PJFF (CD)	0.015	322	750	72,696	12,454	NA	16,605	6,895	NA ¹
Pre-CD	0.050	1072	NA	NA	NA	NA	NA	NA	NA
Unit 4									
WESP	0.010	210	105	130,012	15,609	29,352	148,657	1,728	NA ¹
PJFF (CD)	0.015	315	737	73,328	12,527	NA	16,997	6,895	NA ¹
Pre-CD	0.050	1052	NA	NA	NA	NA	NA	NA	NA

¹ PNM performed an impact analysis for these technologies and incorporated any monetized energy or non-air environmental impacts into the cost analysis.

Step 5 of the BART Analysis: Visibility Impacts Analysis of Remaining Control Technologies

The Guidelines require states to assess visibility improvement based on the modeled change in visibility impacts for the pre-control and post-control emission scenarios.

The objective of this source-specific, refined modeling analysis report is to describe the methodologies and procedures of visibility modeling to support the BART engineering analysis for PNM's SJGS Units 1, 2, 3, and 4. These units were identified as subject-to-BART by the Department based on BART screening exemption modeling conducted by the Western Regional Air Partnership's (WRAP) Regional Modeling Center (RMC). Based on the results of the WRAP screening modeling, PNM SJGS was required to conduct a refined BART analysis that included CALPUFF visibility modeling for the facility.

The modeling approach followed the requirements described in the WRAP's BART modeling protocol, *CALMET/CALPUFF Protocol for BART Exemption Screening Analysis for Class I Areas in the Western United States* dated August 15, 2006.

The CALPUFF modeling system is described below, followed by a description of the modeling analysis performed in 2011, and, finally, by a description of the updated modeling performed in 2013 that takes into consideration the State Alternative.

CALPUFF System

The CALPUFF modeling system consists of a meteorological data pre-processor (CALMET), an air dispersion model (CALPUFF), and post-processor programs (POSTUTIL, CALSUM, CALPOST). The CALPUFF model was developed as a non-steady-state air quality modeling system for assessing the effects of time-varying and space-varying meteorological conditions on pollutant transport, transformation, and removal.

CALMET is a diagnostic wind model that develops hourly wind and temperature fields in a three-dimensional, gridded modeling domain. Meteorological inputs to CALMET can include surface and upper-air observations from multiple meteorological monitoring stations. Additionally, the CALMET model can utilize gridded analysis fields from various mesoscale models such as MM5 to better represent regional wind flows and complex terrain circulations. Associated two-dimensional fields such as mixing height, land use, and surface roughness are included in the input to CALMET. The CALMET model allows the user to “weight” various terrain influence parameters in the vertical and horizontal directions by defining the radius of influence for surface and upper-air stations.

CALPUFF is a multi-layer, Lagrangian puff dispersion model. CALPUFF can be driven by the three-dimensional wind fields developed by the CALMET model (refined mode), or by data from a single surface and upper-air station in a format consistent with the meteorological files used to drive steady-state dispersion models. All far-field modeling assessments described here were completed using the CALPUFF model in the refined mode.

CALSUM is a post-processing program that can operate on multiple CALPUFF output files to combine the results for further post-processing. POSTUTIL is a post-processing program that combines the concentrations, wet and dry deposition flux files created by CALPUFF to calculate the total nitrogen and total sulfur deposition fluxes from nitrogen dioxide (NO₂), nitrates (NO₃⁻), nitric acid (HNO₃), sulfur dioxide (SO₂) and sulfates (SO₄²⁻). CALPOST is a post-processing program that can read the CALPUFF (or POSTUTIL or CALSUM) output files and calculate the impacts to visibility.

The 2011 refined CALPUFF modeling was conducted with the version of the CALPUFF system recommended by the WRAP BART modeling protocol. The 2013 refined CALPUFF modeling was conducted with the version of the CALPUFF system recommended by the EPA Version designations of the key programs listed in Table 12.

Table 12: CALPUFF System Used

	2011 Modeling		2013 Modeling	
	Version	Level	Version	Level
CALMET	6.211	060414	5.8	070623
CALPUFF	6.112	060412	5.8	070623
POSTUTIL	1.52	060412	1.56	070627
CALSUM	1.33	051122	1.33	051122
CALPOST	6.131	060410	6.221	080724

Meteorological Data Processing (CALMET)

The CALMET model was used to construct an initial three-dimensional windfield using data from the MM5 model. Surface and upper-air data were input to CALMET to adjust the initial windfields. Because the MM5 data were afforded to simulate atmospheric variables on the CALMET windfields, the daily MM5 meteorological data files provided by the WRAP RMC for the years 2001, 2002, and 2003 were utilized as input into CALMET for the 2011 analysis. In the 2013 updated analysis, surface, upper air, precipitation, and MM5 data were provided by EPA. Locations of the observations that were input to CALMET for both the 2011 analysis and the 2013 analysis, including surface and precipitation stations, are shown in Figures 1 and 2. Default settings were used in the CALMET input files for most of the technical options. Table 13 lists the key user-defined CALMET settings that were selected.

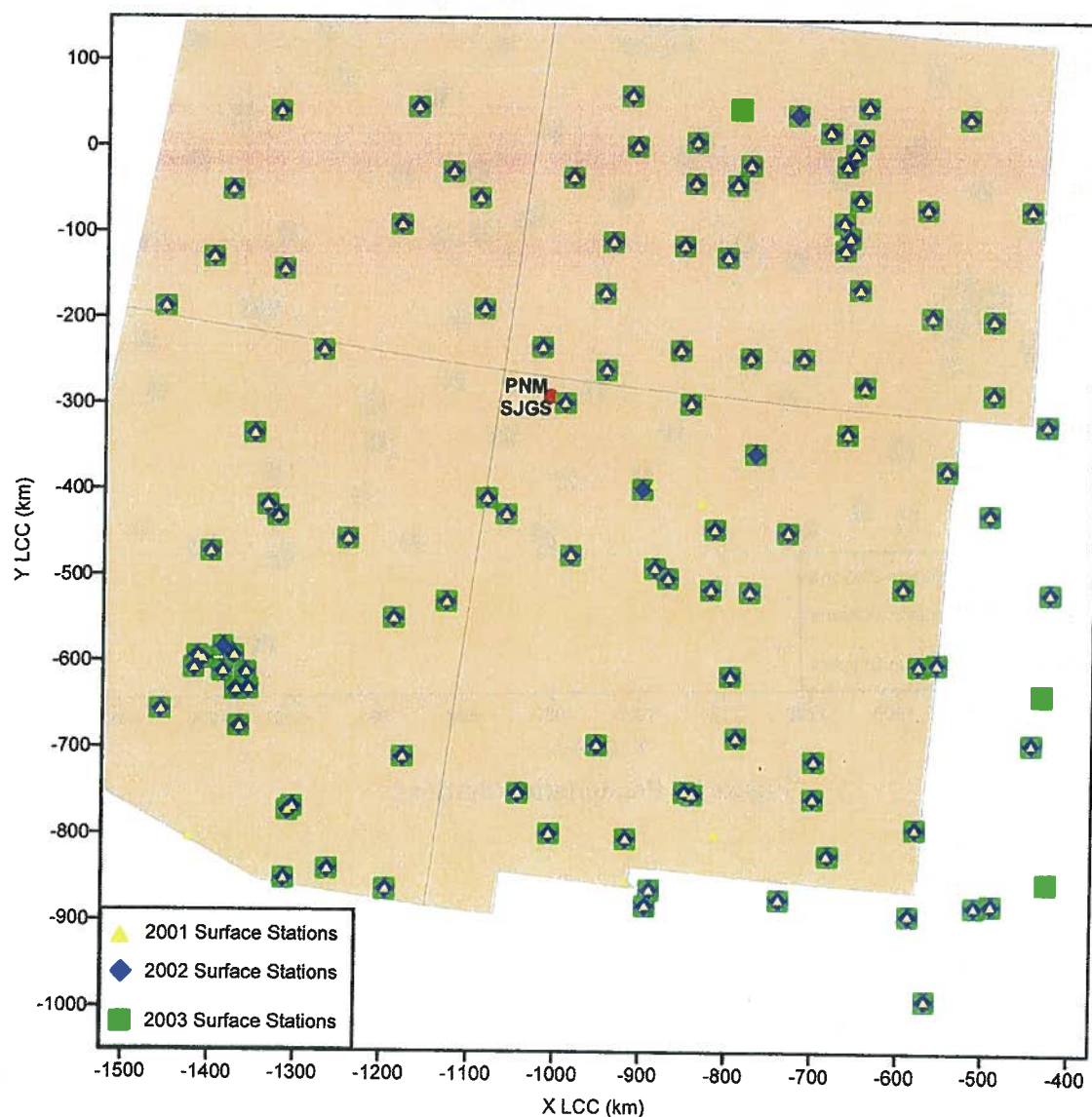


Figure 1: Surface Stations

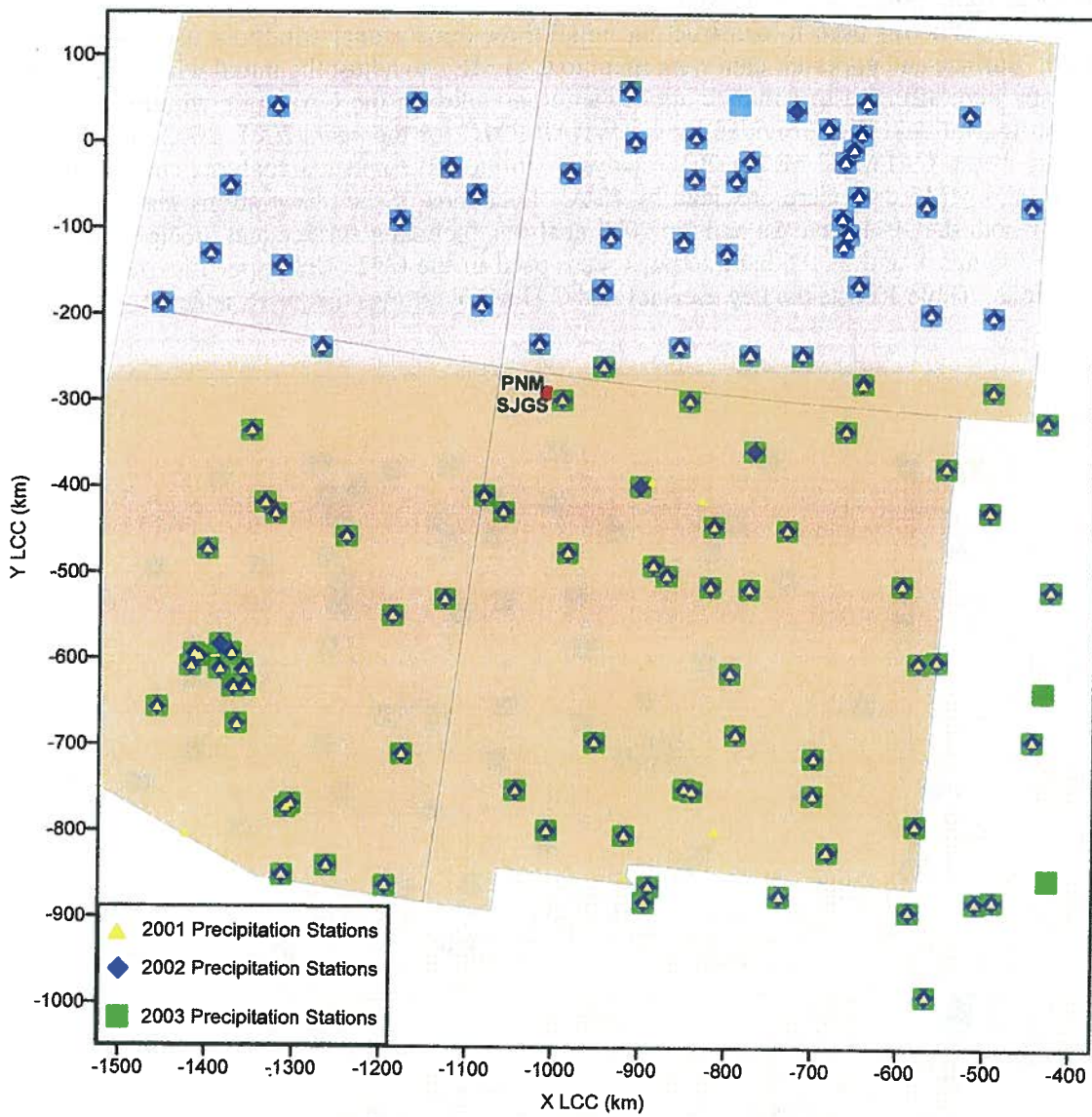


Figure 2: Precipitation Stations

Table 13: Key User-Defined CALMET Settings

Variable	Description	Value	
		2011 Analysis	2013 Analysis
PMAP	Map projection	LCC	LCC
DGRIDKM	Grid spacing (km)	4	4
NZ	Number of layers	11	11
ZFACE	Cell face heights (m)	0, 20, 100, 200, 350, 500, 750, 1000, 2000, 3000, 4000, 5000	0, 20, 100, 200, 350, 500, 750, 1000, 2000, 3000, 4000, 5000
NOOBS	1=Use of surface and precipitation (no upper air observations); use MM5 for upper air data	1	0
IEXTRP	Extrapolate surface wind obs to upper level	1	-4
RMIN2	Minimum distance for extrapolation	4	4
IPROG	Use gridded prognostic model output	14	14
RMAX1	Maximum radius of influence (surface layer, km)	50	100
RMAX2	Maximum radius of influence (layers aloft, km)	100	200
TERRAD	Radius of influence for terrain (km)	10	10
R1	Relative weighting of first guess wind field and observation (km)	100	50
R2	Relative weighting aloft (km)	200	100
ITPROG	3D temperature from observations or from MM5	1	0

CALPUFF Modeling Setup

To allow chemical transformations within CALPUFF using the recommended chemistry mechanism (MESOPUFF II), the model required input of background ozone and ammonia concentrations. Background ozone concentrations are important for the photochemical conversion of SO₂ and NO_x to SO₄ and NO₃, respectively. In the 2011 analysis, for ozone, the hourly ozone concentration files that were used by the WRAP RMC in the initial modeling were used for the BART technology evaluation. In addition to the hourly ozone data, the same monthly average background ozone value of 80 ppb that was used in the initial modeling was used in this modeling for times when hourly ozone data were not available. In the 2013 analysis, the hourly ozone concentrations files that came directly from EPA were used and the ozone concentration of 80 ppb was used for the missing hours in the ozone data files.

For ammonia, in the 2011 analysis, the monthly variable background ammonia concentrations were used for the BART modeling analysis. They are as follows:

Table 14: Ammonia Background Concentration (ppb)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.2	0.2	0.5	0.5	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.2

In the 2013 analysis, a constant ammonia background concentration of 1.0 ppb was used.

There are many Class I areas within and surrounding New Mexico. On the basis of distance from BART applicable sources, topography, and meteorology, the screening modeling conducted by WRAP RMC determined that 16 Class I areas needed to be addressed in the BART analysis. The applicable Class I areas included in the BART analysis are located within 300 km of the SJGS facility. As shown in Figure 3, the nearest Class I area is Mesa Verde National Park, located approximately 40 km north of the facility and the most distant Class I area is Grand Canyon National Park, located approximately 300 km west of the facility. All Class I area distances from the facility fall within the range recommended for CALPUFF application. The 16 Class I areas are identified in Table 15 and an illustration of the receptors used in the 2011 and 2013 modeling analyses for each Class I area is provided in Appendix B. The CALPUFF analyses used an array of discrete receptors with receptor elevations for the Class I areas, which were created and distributed by the National Park Service (NPS).

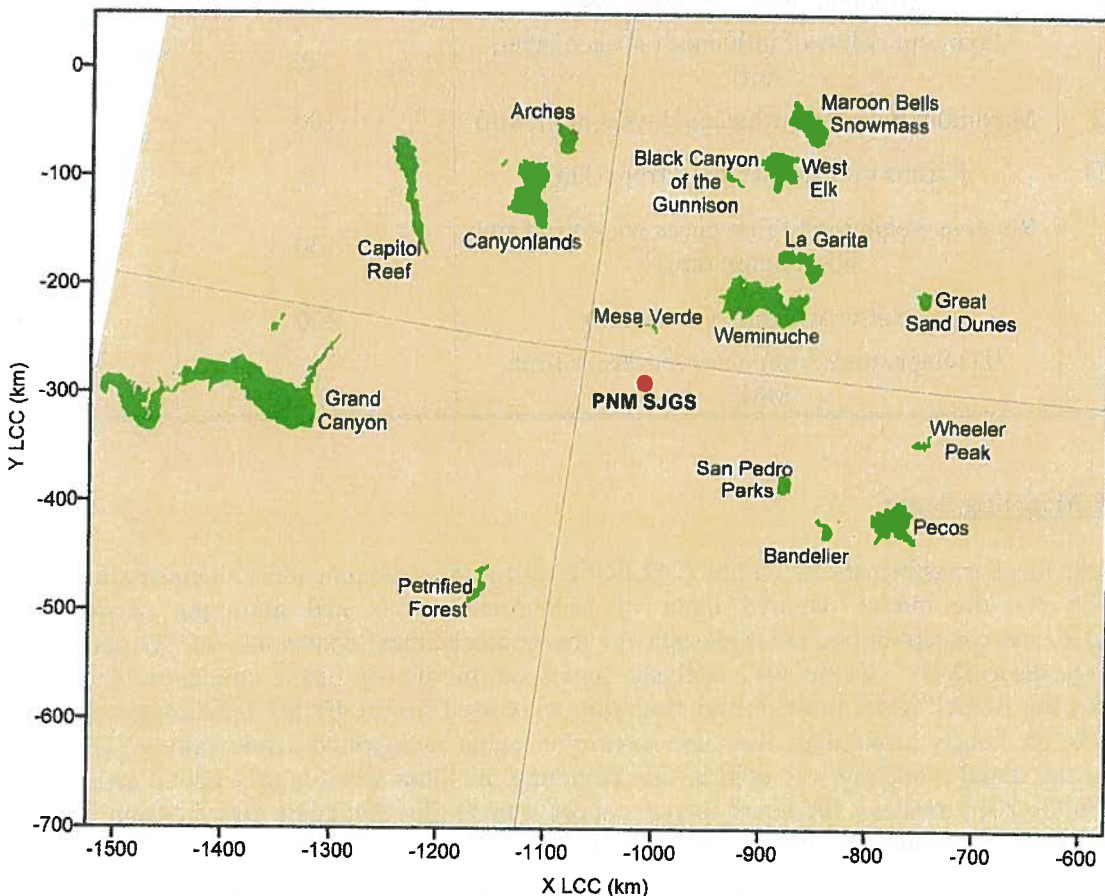


Figure 3: Location of SJGS and the Class I Area

Table 15: Class I Areas

1. Mesa Verde National Park (MEVE)	9. West Elk Wilderness (WEEL)
2. Weminuche Wilderness (WEMI)	10. Arches National Park (ARCH)
3. San Pedro Parks Wilderness (SAPE)	11. Capitol Reef National Park (CARE)
4. La Garita Wilderness (LAGA)	12. Pecos Wilderness (PECO)
5. Canyonlands National Park (CANY)	13. Wheeler Peak Wilderness (WHPE)
6. Black Canyon of the Gunnison National Park (BLCA)	14. Great Sand Dunes National Park (GRSA)
7. Bandelier National Monument (BAND)	15. Maroon Bells-Snowmass Wilderness (MABE)
8. Petrified Forest National Park (PEFO)	16. Grand Canyon National Park (GRCA)

CALPUFF Inputs – Pre-Consent Decree, Baseline and Control Options

Source release parameters and emissions for pre-consent decree, baseline and control options for each unit are shown in Tables 16 through 19. The following notes apply to each of these tables:

- (1) Emissions levels (lb/MMBtu) are shown on an annual average basis.
- (2) Emissions (lb/hr) calculations were based on the emissions level (lb/MMBtu) and design heat basis.
- (3) Emissions levels listed were based on performance guarantees provided by the equipment vendor.
- (4) H₂SO₄ is assumed to be 100 percent of the SO₄ emissions calculated by the NPS Speciation Spreadsheet.

Table 16: CALPUFF Inputs for Unit 1

[illegible]

2011 Analysis

2013 Analysis

1

2011 Analysis

2013 Analysis

Stack Conditions

Table 19: CALPUFF Inputs for Unit 4

[illegible]

Visibility Post-Processing (CALPOST)

In the 2011 analysis, visibility (or 98th percentile delta deciview (dv)) was calculated using Method 6 in CALPOST and Annual Average Natural Conditions, as recommended by the WRAP RMC protocol.

The 2013 analysis used the revised IMPROVE equation (Method 8) and the Annual Average Natural Conditions, as recommended by EPA. The Annual Average Natural Conditions used in the 2011 and 2013 analyses are shown in Table 20. They are specifically for the western half of the United States, included in Table 2-1 of EPA's *Guidance for Estimating Natural Visibility Conditions Under Regional Haze Rule* (EPA-454/B-03-005, September 2003).

Table 20: Average Annual Natural Background Levels^(a)

Component	Average Annual Natural Background ($\mu\text{g}/\text{m}^3$)
Ammonium Sulfate	0.12
Ammonium Nitrate	0.10
Organic Carbon Mass	0.47
Elemental Carbon	0.02
Soil	0.50
Coarse Mass	3.00
^(a) Table 2-1 of the EPA's <i>Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule</i> .	

Modeling Results of 2011 Analysis

Using the air dispersion modeling methodology outlined in the previous section, a CALPUFF model run was conducted, with meteorological data for the years 2001-2003, for the following control technologies for each unit: for NO_x, pre-consent decree, Consent Decree, SNCR or Rotamix, ROFA/Rotamix, ROFA, SCR/SNCR Hybrid (SCR/SNCR Hybrid with Inherent SO₃ Removal), SCR with Sorbent (SCR with Inherent SO₃ Removal and Sorbent Injection); and for PM, pre-consent decree, Consent Decree, PJFF, and WESP. To simplify the quantity of the modeling results, total visibility impacts at all 16 Class I areas were used to make comparisons of each control technology's performance.

For both the facility-wide and unit-by-unit modeling analysis conducted, the expected degree of visibility impact for each control technology was determined as the difference between the projected visibility impact after installation of that control and annual average natural visibility conditions, for each receptor at each of the 16 Class I areas. The difference is given as delta-deciview (delta-dv).

Visibility Impact of NO_x Control Technology

The results of the visibility modeling for Unit 1, Unit 2, Unit 3, and Unit 4 for each of the NO_x control technologies are summarized in Figures 4-7:

Figure 4 illustrates the maximum visibility deciview impact for each NO_x control technology seen at each Class I area for the years 2001-2003 on a facility-wide basis.

Figure 5 illustrates the maximum visibility deciview impact for each NO_x control technology seen at **each Class I area** for the years 2001-2003 on a **unit-by-unit basis**.

Figure 6 illustrates the maximum visibility deciview impact for each NO_x control technology seen at **Mesa Verde National Park** for the years 2001-2003 on a **facility-wide basis**.

Figure 7 illustrates the maximum visibility deciview impact for each NO_x control technology seen at **Mesa Verde National Park** for the years 2001-2003 on a **unit-by-unit basis**.

Visibility Impact of PM Control Technology

The visibility modeling performed for the WESP control option was performed on a facility-wide and unit-by-unit basis. The results of the facility-wide analysis demonstrated a net improvement of 0.62 dv at Mesa Verde National Park and a 0.14 dv improvement at San Pedro Parks Wilderness Area. The amount of visibility improvement at all other Class I areas was equal to or less than 0.1 dv improvement.

The results of the unit-by-unit impact analysis demonstrate a 0.21 dv improvement for Units 3 and 4 at Mesa Verde National Park. However, all other impact analyses show less than a 0.1 dv improvement at any of the Class I areas for Units 1-4.

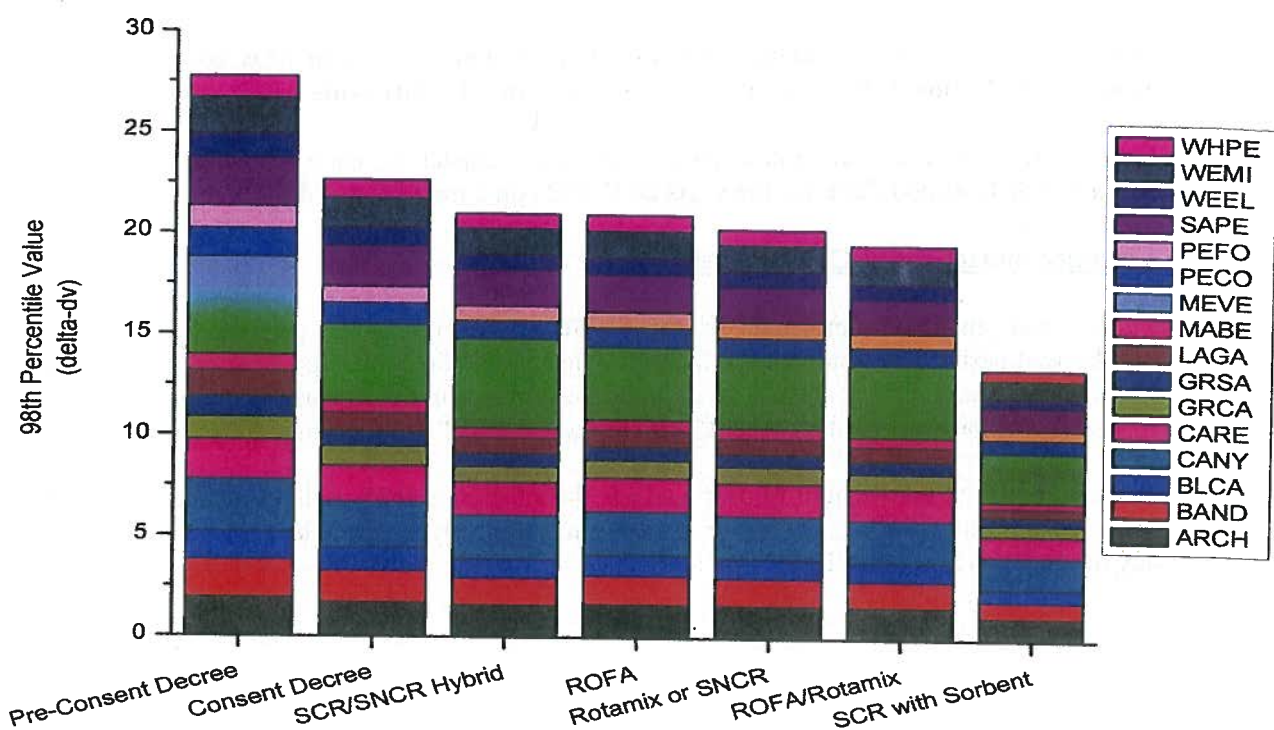


Figure 4: Total Amount of the Visibility Impacts at All 16 Class I Areas Using 2001-2003 Meteorological Data (facility-wide impact) (2011 Analysis)

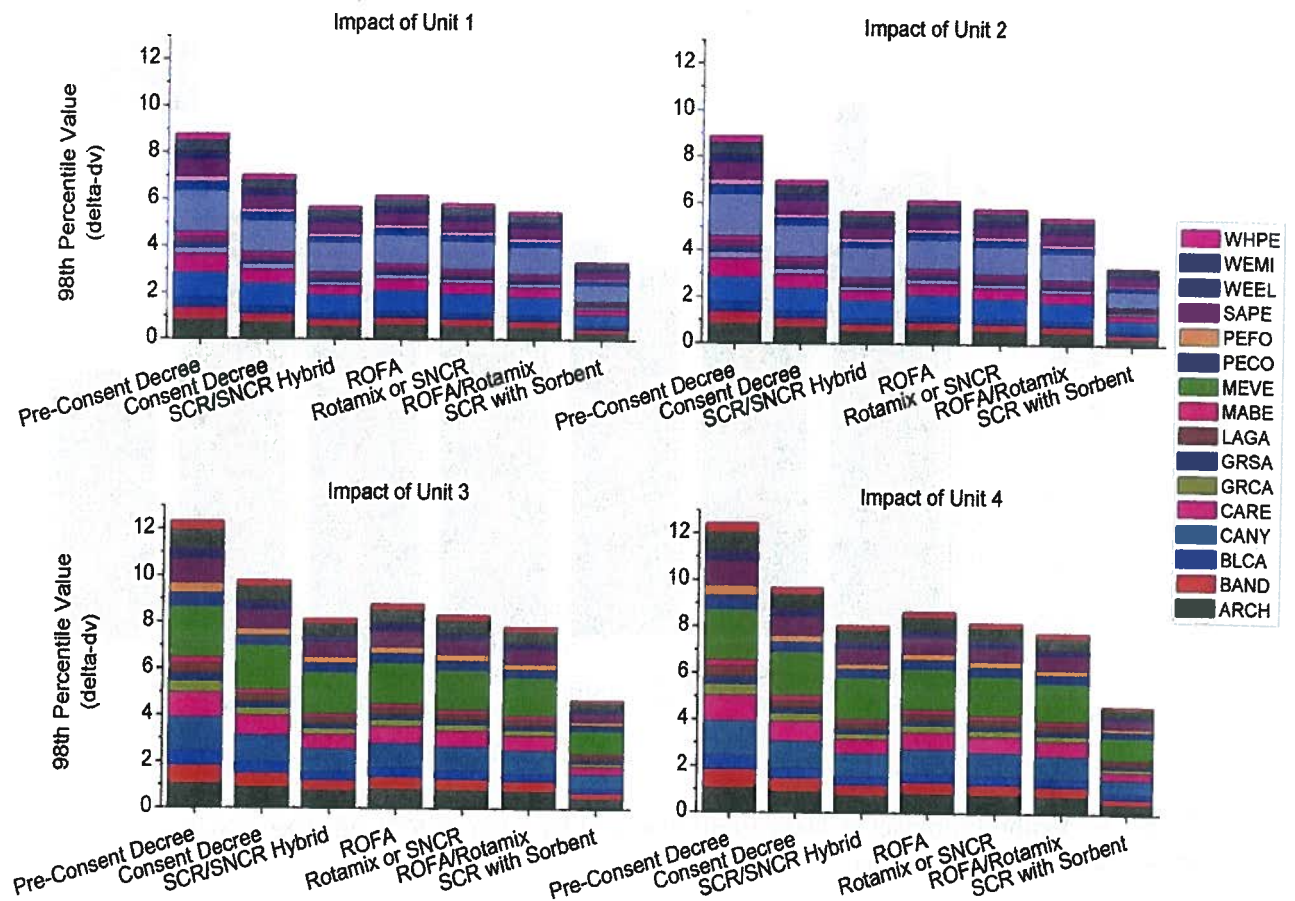


Figure 5: Total Amount of the Visibility Impacts at All 16 Class I Areas Using 2001-2003 Meteorological Data (units 1, 2, 3, and 4) (2011 Analysis)

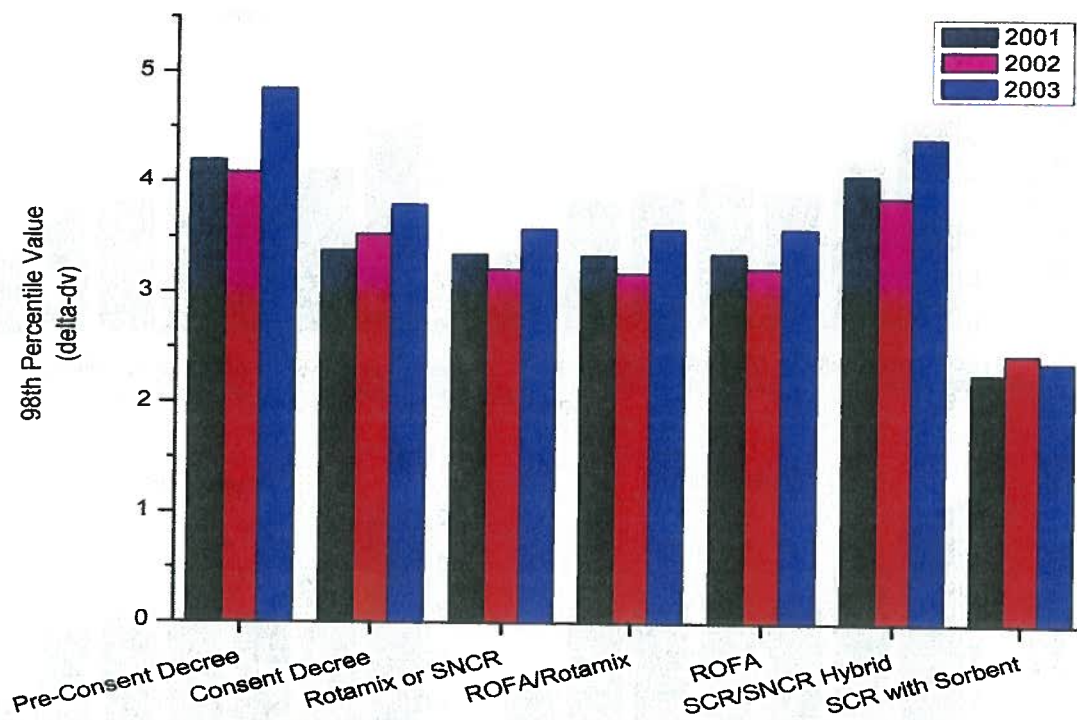


Figure 6: Visibility Impact at Mesa Verde National Park Using 2001-2003 Meteorological Data (facility-wide impact) (2011 Analysis)

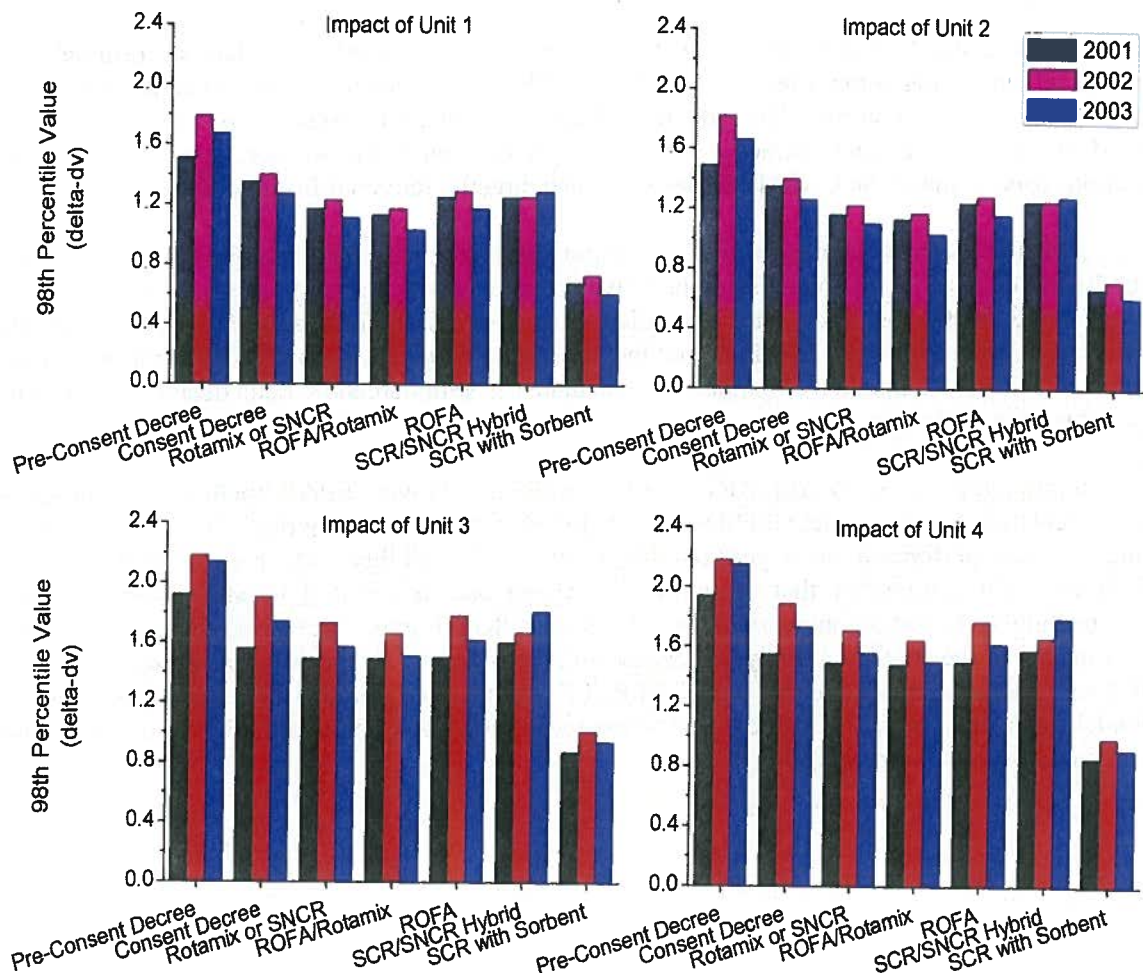


Figure 7: Visibility Impact at Mesa Verde National Park Using 2001-2003 Meteorological Data (units 1, 2, 3, and 4) (2011 Analysis)

Updated Visibility Modeling Assessment Submitted April 1, 2013

PNM submitted updated visibility modeling for SJGS with revised emission estimates for sulfur dioxide (SO₂), sulfuric acid (H₂SO₄), and total particulate matter (TPM). The modeling analysis compared available nitrogen oxide (NO_x) control technologies including selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), as well as unit retirements as an alternative operating scenario that had not previously been analyzed. PNM's updated BART modeling incorporated SJGS's new SO₂ and total particulate matter (TPM) emission rates of 0.15 lb/MMBtu and 0.034 lb/MMBtu, respectively, from the current NSR permit effective August 31, 2012. These emission limits have been incorporated into the Baseline modeling scenario, including EPA's FIP scenario representing four SCRs, and the NMED's SIP scenario representing four SNCRs. The updated BART modeling also incorporated H₂SO₄

emission rates of 0.00026 lb/MMBtu and 0.000046 lb/MMBtu for SCR and non-SCR, respectively, for the scenarios detailed in Table 21.

PNM utilized the EPA-approved CALPUFF version 5.8, the CALMET data set originally created by EPA, and modeling input files as modified by EPA to reflect the source specific parameters for the specific modeling scenarios. The modeled CALPUFF domain, receptors, ozone data, and CALMET data used in this analysis came directly from EPA. Additionally, the surface, upper air, and precipitation stations used to make the CALMET files were also directly delivered from the EPA.

The NMED approved the use of all of the input parameters and data compiled by EPA for the updated modeling analysis. The condensable particulate matter (PM) emission rates used in the 2013 modeling were based on the facility's total particulate matter emission limit as established in the NSR permit effective August 31, 2012. PNM utilized the default ammonia background concentration of 1 ppb and the revised IMPROVE equation (Method 8) to calculate the 98th percentile delta deciview (dv) from modeled pollutant concentrations.

The meteorology used for the SJGS BART analysis followed EPA's methodology described in the Technical Support Document (TSD) and included with EPA's proposed 2011 FIP⁷. The modeling analysis was performed on a year-by-year basis for the facility-wide impact for the four scenarios. Ammonia slip (ammonia that is not fully reacted and is emitted to atmosphere) associated with combustion NOx reduction systems may be higher than 1 ppb. However, the ammonia slip was not considered in the modeling analysis because EPA determined in the FIP that it would not significantly impact visibility improvement. The CALPUFF system used for the 2011 modeling and the updated modeling is summarized in Table 12. The emissions and stack parameters for the updated modeling are shown in Tables 16 through 19.

Table 21: Target Emissions for Modeling Scenarios

Scenario	Operation and Target Emissions
Baseline	Units 1-4 operating only with existing air pollution control technology and new permitted SO ₂ and Total Particulate Matter (TPM) emission rates of 0.15 lb/MMBtu and 0.034 lb/MMBtu, respectively. Sulfuric Acid (H ₂ SO ₄) emission rate of 0.000046 lb/MMBtu
EPA FIP	Units 1-4 operating with existing air pollution control technology and with new SCR installation; NO _x at 0.05 lb/MMBtu and new permitted SO ₂ and TPM emission rates of 0.15 lb/MMBtu and 0.034 lb/MMBtu, respectively. Sulfuric Acid (H ₂ SO ₄) emission rate of 0.00026 lb/MMBtu
NMED SIP	Units 1-4 operating with existing air pollution control technology and with new SNCR installation; NO _x at 0.23 lb/MMBtu and new permitted SO ₂ and TPM emission rates of 0.15 lb/MMBtu and 0.034 lb/MMBtu, respectively. Sulfuric Acid (H ₂ SO ₄) emission rate of 0.000046 lb/MMBtu
State Alternative Plan	Units 2 & 3 retired, Units 1 & 4 operating with existing air pollution control technology and with new SNCR installation; NO _x at 0.23 lb/MMBtu, permitted TPM emission rate of 0.034 lb/MMBtu, and a reduced SO ₂ emission rate of 0.10 lb/MMBtu. Sulfuric Acid (H ₂ SO ₄) emission rate of 0.000046 lb/MMBtu

Discussions and Conclusions

PNM remodeled the visibility impacts of SJGS using the revised emission estimates, the EPA-approved CALPUFF version 5.8, and the meteorological data provided by EPA as previously discussed. PNM provided NMED with all the modeling results performed on a year-by-year basis for the facility-wide impact for the four scenarios. NMED explored the modeling results to present the visibility improvement in two ways: 98th percentile deciview (dv) at each Class I area for the four scenarios and deciview improvement at each Class I area with addition NO_x control technologies on the existing air pollution control technology.

CALPOST, the postprocessor for CALPUFF, calculates the maximum visibility impacts of all locations (receptors) in the 16 Class I areas for each day. Each modeled day and location has an associated delta deciview, which is the difference between deciviews and includes the impact at the SJGS and natural background, and deciviews of the natural background alone. From these daily values, the value of the 98th percentile (approximately equivalent to the 8th highest day) recommended by the BART guidelines is used for comparing the effects of each scenario in improving visibility. The line and symbol graph in Figure 8 shows the 98th percentile at the 16 Class I areas and the impact of each scenario.

As illustrated in Figure 8, the EPA FIP and State Alternative Plan reduce visibility impairment more than the NMED SIP submitted in July 2011 for the three years from 2001 through 2003. Mesa Verde National Park shows the highest 98th percentile among the 16 Class I areas and is the nearest Class I area, located

approximately 40 km north of the facility. Grand Canyon National Park shows the lowest 98th percentile and is located in the most distant area, located approximately 300 km west of the SJGS. When the frequency of the occurrence of the peak 98th percentile is compared to each BART technology scenario, the figure depicts that the State Alternative Plan and the EPA FIP more significantly reduce the peak 98th percentiles than the NMED SIP scenario does. The 98th percentile value of the sixteen Class I areas is added up for each scenario separately for the comparison of a general visibility improvement, as shown in Figure 9.

The days exceeding a 0.5 dv threshold are determined at each Class I area for each BART technology scenario for each of the three years. The average and maximum days exceeding the threshold value are calculated and graphed in Figure 10. Figure 10 shows that the State Alternative Plan and the EPA FIP significantly improve visibility as compared to the Baseline and NMED SIP scenarios. The State Alternative Plan closely matches the EPA FIP scenario.

The visibility improvement from additional NO_x control technologies beyond the base case is shown in Figure 11. The results indicate that the State Alternative Plan and the EPA FIP achieve greater visibility improvement than projected for the NMED SIP scenario. The State Alternative Plan is virtually indistinguishable from the EPA FIP in improving visibility, with a difference of less than 0.5 dv at any one Class I area.

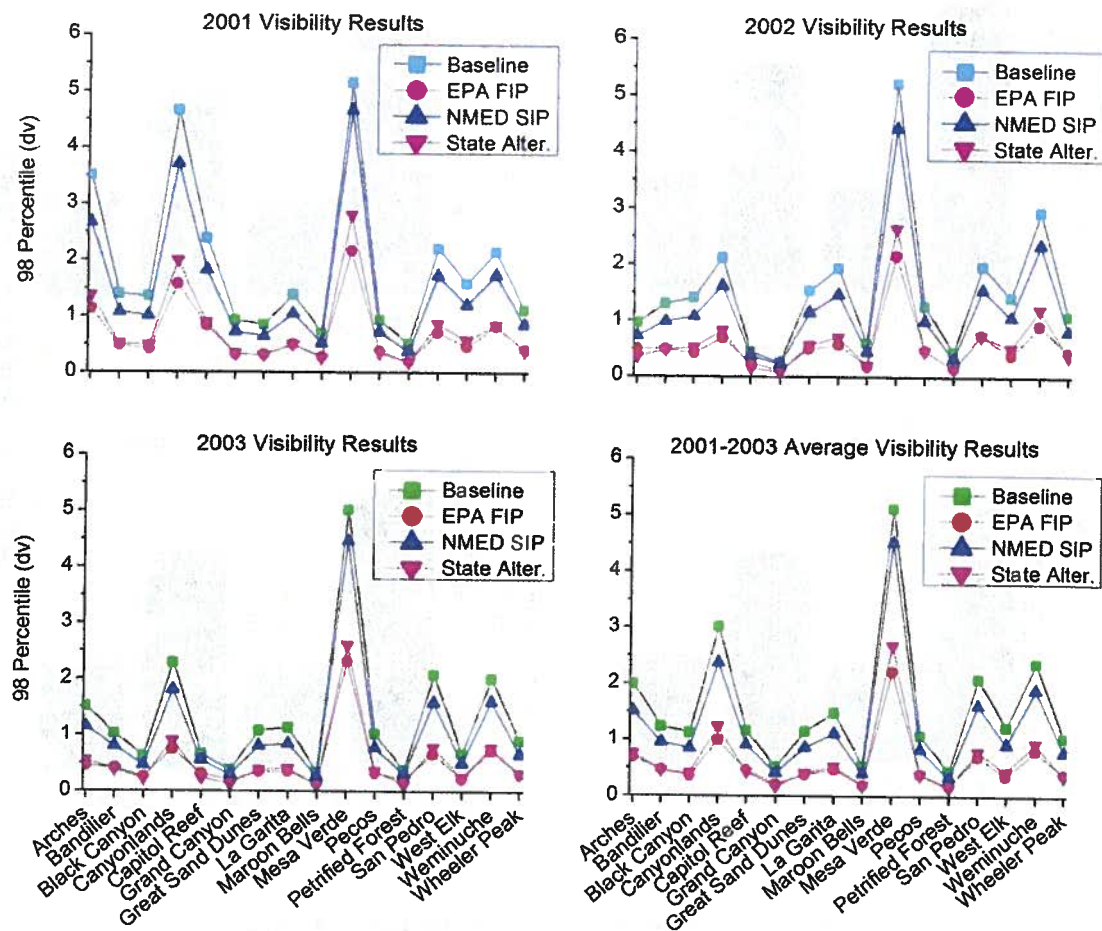


Figure 8: 98th Percentile on the 16 Class I areas (2013 Analysis)

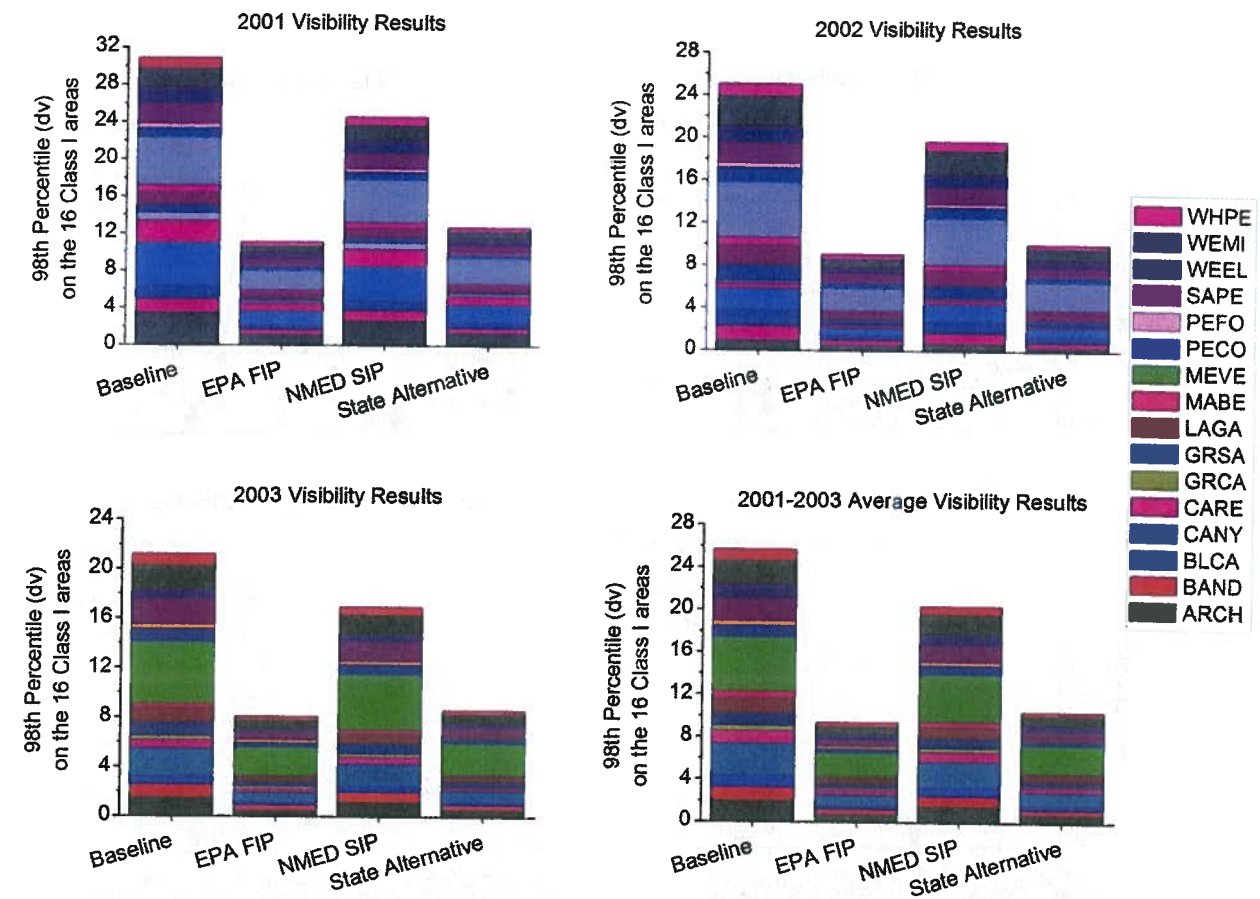


Figure 9: Visibility Impact Results (2013 Analysis)

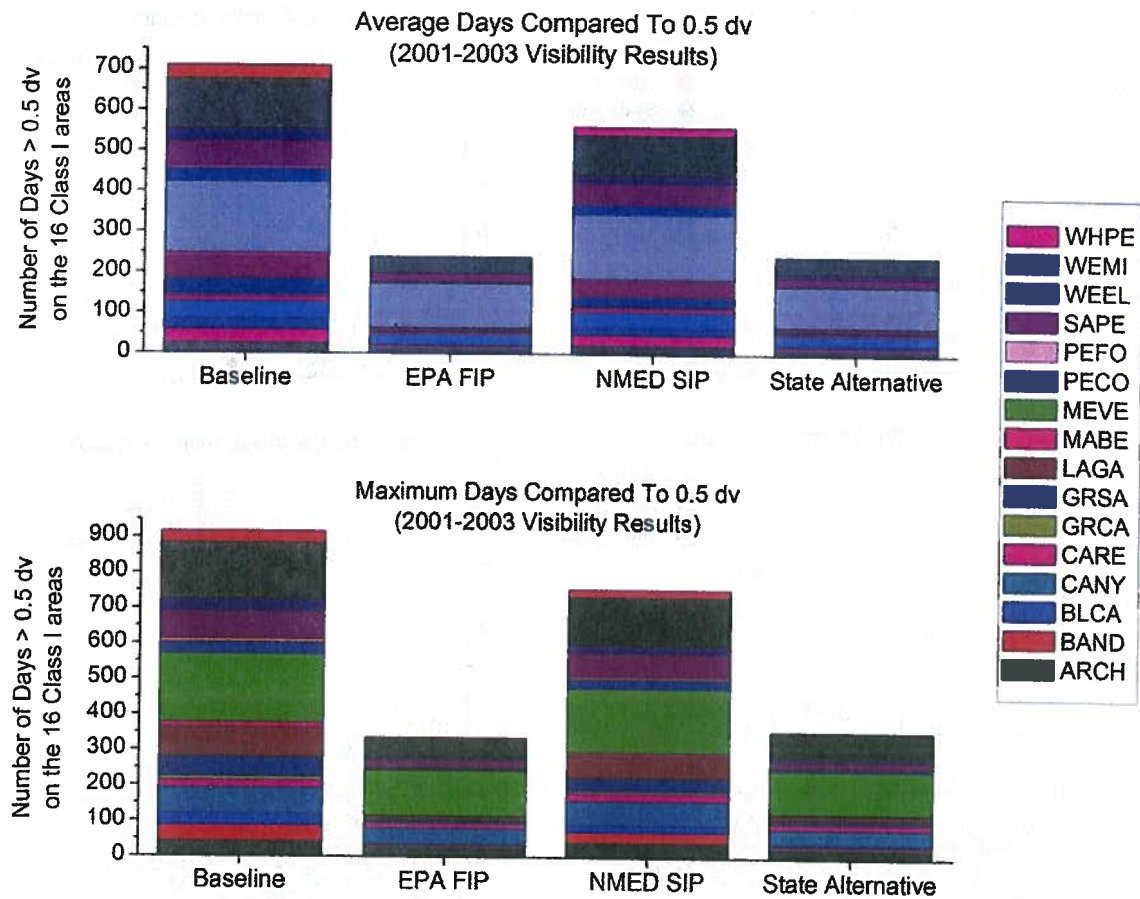


Figure 10: Average and Maximum Days Compared to 0.5 dv (2013 Analysis)

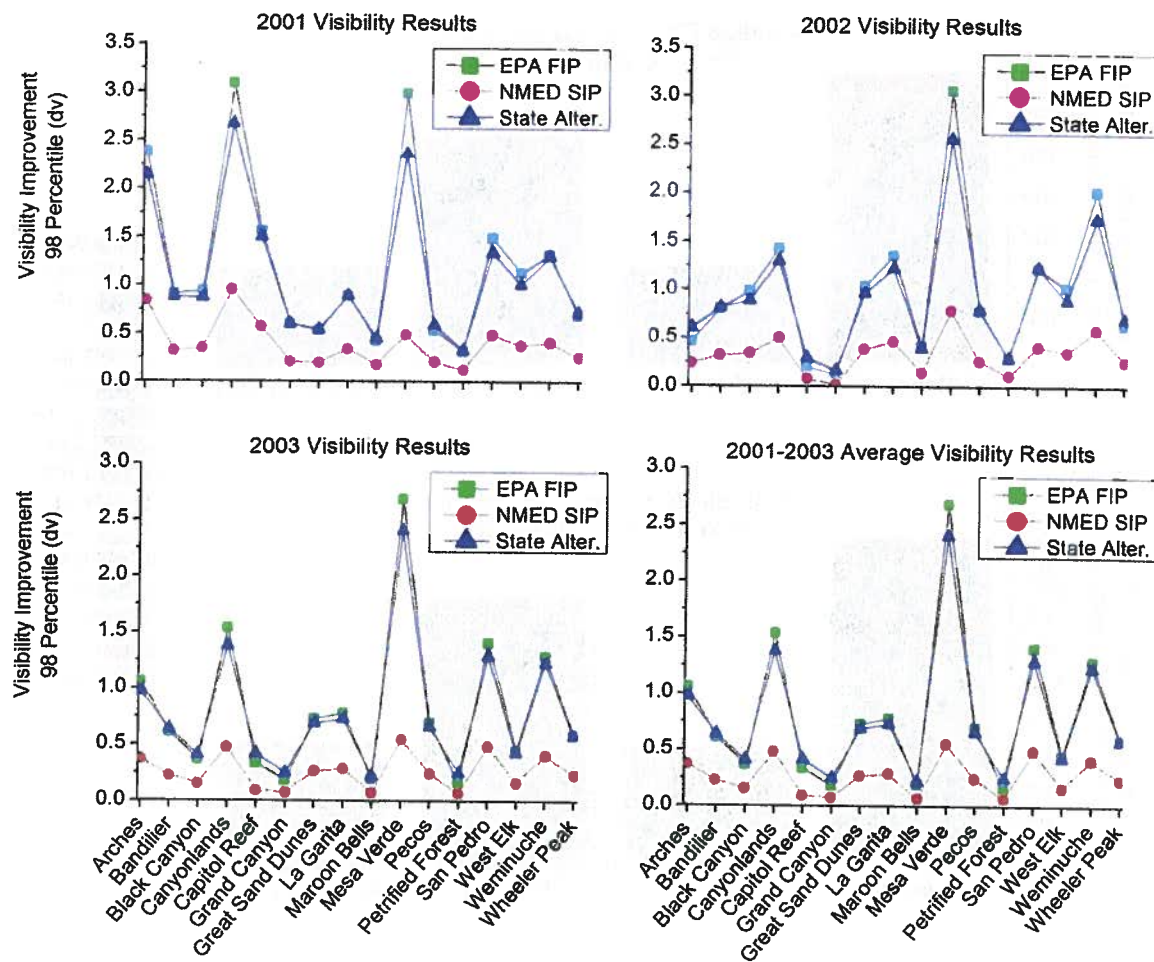


Figure 11: Visibility Improvement of the EPA FIP, NMED SIP, and State Alternative Scenarios (2013 Analysis)

Department Assessment of BART for NO_x and PM

In accordance with Section 169A(g)(7) of the Clean Air Act, the Department considered the following five statutory factors in the BART analysis for the SJGS: (1) the costs of compliance; (2) energy and non-air quality environmental impacts of compliance; (3) any existing pollution control technology in use at the source; (4) the remaining useful life of the source; and (5) the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

PM BART Assessment

Based on the 2011 five factor analysis, the Department has determined that BART for Units 1, 2, 3, and 4 for PM is existing PJFF technology and the existing emission rate of 0.015 lb/MMBtu. The Department's determination of BART was based on the following results of the full five factor analysis:

- 1) Each of Units 1, 2, 3 and 4 are equipped with PJFF and are subject to a federally-enforceable emission limit of 0.015 lb PM/MMBtu.
- 2) The Department reviewed both the cost-effectiveness and incremental cost-effectiveness of additional control technology (WESP) and found these costs to be excessive. See Table 11.
- 3) There are additional energy impacts associated with the WESP technology and the Department considers these costs to be reasonable.
- 4) The Department reviewed the visibility improvement that resulted from the installation of the consent decree technology (PJFF and LNB/OFA) and that would result from the addition of WESP technology. The Department determined that on a facility-wide basis the visibility improved by 1.06 deciviews (dv) from the installation of the consent decree technology at Mesa Verde National Park (Mesa Verde). The installation of WESP would result in a facility-wide improvement of 0.62 dv at Mesa Verde. Improvements on a unit-by-unit basis at all Class I areas showed very minor improvements, usually less than 0.1 dv.

2011 NO_x BART Determination

Based on the five factor analysis, the Department has determined that, for the Facility comprising Units 1, 2, 3, and 4, BART for NO_x is SNCR technology at an emission rate of 0.23 lb/MMBtu on a 30-day rolling average. The Department's determination of BART was based on the following results of the five factor analysis:

- 1) SNCR technology was considered cost-effective at an average cost of \$3,494 per ton of NO_x removed. SNCR technology will reduce the facility annual NO_x emissions by 4,900 tons. (In the updated 2013 analysis, the cost estimate increased to \$5,589 per ton. While still cost effective, this higher cost makes the State Alternative more attractive.)
- 2) The SNCR technology would result in additional energy impacts and non-air impacts from a new reagent system and a reagent storage system. The Department considered these additional costs in the review of the overall cost-effectiveness of SNCR and found these costs to be reasonable.

- 3) The Department reviewed the visibility improvement that resulted from the installation of the SNCR technology on Units 1, 2, 3 and 4. The Department determined that on a facility-wide basis the visibility improved by 0.25 dv at San Pedro, 0.22 dv at Mesa Verde, and 0.21 dv at Bandelier.
- 4) An emission limit of 0.23 lb NO_x/MmBtu at each of Units 1, 2, 3 and 4 equals the EPA's established presumptive limit for dry-bottom, wall-fired boilers burning sub-bituminous coal.
- 5) The Department reviewed additional economic information provided by PNM that analyzed the economic impact to ratepayers in New Mexico. The PNM estimates indicate the cost of control technology beyond SNCR would be financially burdensome and cause economic hardship to low-income New Mexicans. According to the US Census Bureau, as of 2009, 18% of New Mexicans were living below the poverty line, as defined by the federal poverty standards. PNM estimates a rate increase of \$11.50 per year per residential ratepayer from the installation of SNCR versus an estimated rate increase of \$82.00 per year from the installation of SCR.
- 6) The Department has determined that in light of the unreasonable costs of SCR, particularly as reflected in the impact on ratepayers, requiring controls to achieve reductions beyond the most stringent presumptive standard prescribed by the EPA is not justified.

2013 BART Determination

The Department considered the terms of the non-binding agreement between the EPA, NMED and PNM, signed February 15, 2013 (the "State Alternative"), and the resulting significant environmental improvements of this alternative. The main elements of the State Alternative affecting emissions reductions and non-air quality environmental benefits are outlined below:

- 1) PNM will retire Units 2 and 3 by December 31, 2017.
- 2) PNM will obtain the necessary construction permit modification to limit the SO₂ emission rates at Units 1 and 4 to 0.10 lb/MMBtu on a daily rolling 30-day average basis.
- 3) The retirement of Units 2 and 3 will reduce the facility annual NO_x emissions by an additional 10,550 tons. When added to the controlled emission rate of Units 1 and 4, total annual NO_x emission will be reduced by 12,989 tons. Additionally, PNM will conduct performance testing to determine if the SNCRs installed on Units 1 and 4 can achieve significantly less than 0.23 lb/MMBtu.
- 4) The retirement of Units 2 and 3 will reduce raw material usage at the facility, including limestone, activated carbon, coal and No. 2 diesel oil. See table below.

Raw Material	State Alternative Plan (TPY)	Baseline, SIP, and FIP
Limestone ⁽¹⁾	86,052	172,104
Activated Carbon ⁽¹⁾	130	261
Coal ⁽²⁾	2,667,364	5,334,729
No. 2 Diesel Oil ⁽²⁾	1,007,336	2,014,671

(1) Based on 2012 material usage data

(2) Based on 2011 material usage data

- 5) The two-unit retirement scenario will result in a substantial decrease in particulate matter emissions from coal processing, handling and transportation, as well as a substantial reduction in greenhouse gas emissions, mercury and non-mercury emissions, and acid gas emissions as detailed in Table 22 below.
- 6) Water usage is expected to drop by up to approximately 53% to 10,161 acre-feet/year.
- 7) The State Alternative achieves significant visibility improvements as compared to the baseline and installation of SNCR on Units 1-4. The visibility improvements from State Alternative compare very closely with the SCR installation scenario as contained in the FIP (less than 0.5 dv impact at each Class I area).
- 8) The total capital investment of the FIP is estimated at nearly \$861,871,000, as compared to \$34,556,000 for the installation of SNCR at Units 1 and 4. This additional and significant capital expenditure that would be required to comply with the FIP is not justified given the slight and undetectable improvement in visibility of the FIP over the State Alternative.

The Department has determined that the State Alternative, which achieves substantial environmental benefits beyond the requirements of the FIP, the SIP, and the requirements of the BART Guidelines at 40 CFR Part 51 Appendix Y, satisfies the statutory and regulatory requirements of BART.

Table 22: Pollutant Emissions from State Alternative, FIP and NMED SIP

Scenario	NO _x	SO ₂	PM	CO	CO ₂	VOC	Mercury	Non-Hg	Acid Gases
Current	21,000	10,500	2,380	33,507	14,669,968	210	0.0842	5.4	1,488
State Alternative	8,011	3,483	1,184	18,615	7,314,801	104	0.042	2.7	744
State Alternative % Reduction	62%	67%	50%	44%	50%	50%	50%	50%	50%
NMED SIP	16,100	10,500	2,380	33,507	14,699,968	210	0.0842	5.4	1,488
NMED SIP % Reduction	23%	0%	0%	0%	0%	0%	0%	0%	0%
EPA FIP	3,502	10,500	2,380	33,507	14,699,968	210	0.0842	5.4	1,488
EPA FIP % Reduction	83%	0%	0%	0%	0%	0%	0%	0%	0%

References

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5. EPA. (2003). Air Pollution Control Technology Fact Sheet (SCR). Retrieved from <http://www.epa.gov/ttn/catc/dir1/fscr.pdf>
6. EPA. (2003). Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule. http://www.epa.gov/ttncaaal/t1/memoranda/rh_envcurhr_gd.pdf
7. Technical Support Document; Visibility Modeling for BART Determination: San Juan Generating Station, New Mexico. EPA-R06-OAR-0846-0003

The first part of the paper discusses the importance of the research and the objectives of the study. It then presents a literature review of the existing research on the topic. The second part of the paper describes the methodology used in the study, including the data collection and analysis techniques. The third part of the paper presents the results of the study, and the fourth part discusses the conclusions and implications of the findings.

The study was conducted using a quantitative research design. Data was collected from a sample of 100 participants, and the results were analyzed using statistical software. The findings of the study indicate that there is a significant relationship between the variables being studied.

The results of the study suggest that the research has important implications for the field. Further research is needed to explore the relationship between the variables in more detail.

In conclusion, the study has provided valuable insights into the topic and has contributed to the existing body of knowledge. The findings have important implications for the field and suggest that further research is needed.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TEXAS 75202 – 2733

Office of the Regional Administrator

Term Sheet
Between the U.S. Environmental Protection Agency,
Public Service Company of New Mexico and the State of New Mexico

This term sheet reflects a tentative agreement on technical terms and an appended corresponding timeline for action intended to address pollution control requirements for the San Juan Generating Station under the Clean Air Act's requirements for regional haze and interstate transport for visibility. These terms have no binding effect and will only become binding if incorporated into a settlement agreement that receives all necessary EPA and Department of Justice approvals and complies with Section 113(g) of the Clean Air Act, as applicable.

1. The New Mexico Environment Department (NMED) will develop and seek adoption by the New Mexico Environmental Improvement Board ("NM EIB") of a State Implementation Plan (SIP) revision. If the NM EIB approves the SIP revision after following all applicable procedural requirements including notice and a public hearing, the Governor of the State of New Mexico or her designee will submit the SIP revision to EPA for approval with supporting administrative and technical information and visibility modeling. The SIP revision will include the following elements:
 - a. Rulemaking addressing a NO_x Best Available Retrofit Technology (BART) determination and enforceable emissions limits for SO₂.
 - b. A five-factor BART analysis in accordance with the BART Guidelines, and other EPA guidance, as applicable, including documentation relied upon in making the BART determination. The use of confidential business information will be minimized to the extent practical in making the analysis.
 - c. New Mexico's rulemaking will require that fifteen (15) months after EPA final approval of the Revised SIP, no earlier than January 31, 2016, Public Service Company of New Mexico (PNM) will complete installation of selective non-catalytic reduction (SNCR) technology on SJGS Unit 1 and 4 and achieve an average nitrogen oxide (NO_x) emission rate for Units 1 and 4 of no greater than 0.23 lb/MMBtu on a daily rolling 30-day average basis. Within 30 days after this "Term Sheet" is signed, PNM will submit a project schedule to the State and EPA that demonstrates the critical milestones for meeting the January 31, 2016, installation completion date. The dates that follow with an asterisk (*) in paragraph d. will be revised accordingly if the installation date extends past January 31, 2016 due to delay in EPA's SIP approval.
 - d.
 - i. Testing Program. PNM will commence a program of testing and evaluation, after the installation of the SNCRs. The Testing Program consisting of SNCR Performance Testing, Fuel Performance Testing, and Long-Term Performance

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Evaluation is to be completed no later than January 31, 2017*, unless the Long-Term Performance Evaluation is delayed per the language in paragraph 1.d.iv.

- ii. SNCR Performance Testing will be conducted to develop a targeted ammonia/urea injection rate range at various load levels without exceeding a to-be-agreed-upon preliminary slip limit of between 5 and 10 ppm, with the goal of minimizing NOx emissions. PNM shall provide the results of the performance tests, recommended final slip limit, and target ammonia/urea injection rates to NMED and EPA by April 1, 2016*. PNM will allow up to April 30, 2016* for the agencies to either concur with PNM's slip limit recommendation or to concur on a different slip limit that PNM will comply with for Units 1 and 4.
- iii. PNM will conduct Fuel Performance Testing (in conjunction with the SNCR Performance Testing) of its pre-treated coal technology, so long as it has not been previously determined to result in any detrimental effect to SJGS Units 1 and 4 or their operation, with the objective of further reducing NOx emissions. If the Fuel Performance Testing demonstrates that it does not: (i) measurably increase NOx emissions, or (ii) adversely impact overall unit operations, PNM shall also use such pre-treated coal for the 9-month Long-Term Performance Evaluation Period described below. PNM will also use pre-treated coal on units 2 and 3 when used on units 1 and 4.
- iv. Long-Term Performance Evaluation Period. PNM will begin collecting NOx emission and ammonia/urea injection rate data from Units 1 and 4 on a daily rolling 30-day average basis for nine continuous months beginning on May 1, 2016* and provide such data and any recommendations on the NOx emission limit to NMED and EPA by February 28, 2017* or no later than 28 days after completing the Long-Term Performance Evaluation Period. PNM may request more time if a slip limit is not agreed upon by April 30, 2016*. The Long-Term Performance Evaluation Period must include 60 days between June 1st and August 30th and 60 days between December 1st and February 28th. The Demonstrated Emission Rate will be the highest daily rolling 30-day average emission rate during the 9-month Long-Term Performance Evaluation Period (not including periods of malfunction or abnormal operating conditions) adjusted to three significant digits. If the Demonstrated Emission Rate is greater than or equal to 0.200 lb/MMBtu on a daily rolling 30-day average basis no adjustment to the NOx emission rate for units 1 and 4 will be made. If the Demonstrated Emission Rate is less than 0.200 lb/MMBtu on a daily rolling 30-day average basis PNM will apply for a permit modification by March 31, 2017* (or no later than 60 days after completing the Long-Term Performance Evaluation Period) to reduce the permitted emission rate by 60% of the difference between 0.23 lb/MMBtu and the Demonstrated Emission Rate, provided the revised emission rate does not adversely impact overall unit operations. The permit modification will include the agreed upon ammonia slip limit.
- e. New Mexico's rulemaking will require that no later than six months from NM EIB adoption of SO₂ emission limit in the RH and Interstate Visibility Transport SIP

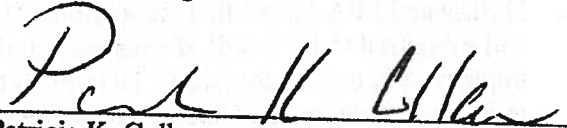
revisions, PNM will comply with new sulfur dioxide ("SO₂") emission rates at Units 1 and 4 of 0.10 lb/MMBtu on a daily rolling 30-day average basis.

- f. New Mexico's rulemaking will require that PNM diligently seek all necessary regulatory approvals to allow for retirement of SJGS Units 2 and 3 by December 31, 2017. New Mexico's rulemaking will require PNM to retire SJGS Units 2 and 3 by December 31, 2017.
2. NMED and EPA intend that the Regional Haze and Interstate Transport SIP revisions as adopted and submitted to EPA will, if approved by EPA, lead to EPA action withdrawing the federal implementation plan for SJGS. Nothing in the Regional Haze and Interstate Transport SIP revisions as adopted and submitted to EPA by New Mexico shall relieve SJGS from its obligations to comply with all applicable federal, state, and local laws and regulations, including laws, regulations, and compliance deadlines that become applicable after the date of any revisions to New Mexico's Regional Haze SIP that may be approved by EPA.
3. NMED also will develop and propose as part of the revised BART determination for PNM, a revision to the Visibility Interstate Transport SIP for NO_x and SO₂. NMED's Visibility Interstate Transport SIP revision will require enforceable emissions limits for NO_x and SO₂ consistent with the emission limits established in the Regional Haze SIP submission in accordance with item 1.
4. PNM agrees that the natural gas combustion turbine(s) to be sited at the San Juan Generating Station to partially replace the retired Unit 2 and Unit 3 coal capacity will undergo BACT analysis and control even if not subject to major source PSD, with the goal of minimizing the visibility impact of emissions of NO_x. PNM agrees that the aggregate annual NO_x emissions from any such on site replacement power shall not exceed 75 tons.

Signature Page for Term Sheet between the U.S. Environmental Protection Agency, Public Service Company of New Mexico, and the State of New Mexico.

FOR PUBLIC SERVICE COMPANY OF NEW MEXICO:

Dated: February 15, 2013

A handwritten signature in dark ink, appearing to read 'Pat K. Collawn', written over a horizontal line.

Patricia K. Collawn
President and CEO
Public Service Company of New Mexico

Signature Page for Term Sheet between the U.S. Environmental Protection Agency, Public Service Company of New Mexico, and the State of New Mexico.

FOR THE STATE OF NEW MEXICO:

Dated: Feb. 15, 2013

A handwritten signature in black ink, appearing to read "F. David Martin", written over a horizontal line.

F. David Martin


Secretary

New Mexico Environment Department

Signature Page for Term Sheet between the U.S. Environmental Protection Agency, Public Service Company of New Mexico, and the State of New Mexico.

FOR THE U.S ENVIRONMENTAL PROTECTION AGENCY:

Dated: February 15, 2013

A handwritten signature in black ink, appearing to read "Ron Curry", is written over a horizontal line.

Ron Curry
Regional Administrator
U.S. Environmental Protection Agency, Region 6

TERM SHEET ATTACHMENT

Timeline

February 15, 2013	EPA Comfort Letter
February 22, 2013	Letter from NMED requesting that EPA not take action on the current SIP.
March 2013	PNM submits new BART analysis to NMED
March 2013	NMED begins work on revised SIP pursuant to the "Term Sheet"
May/June 2013	Request hearing before the EIB and start public comment period
September 2013	Revised SIP presented to EIB
Within 30 Days of preceding event	Revised SIP submitted to EPA
Within 60 Days of preceding event	Completeness Determination (EPA can now determine if additional discussion concerning FIP Compliance Dates is warranted)
Within 135 Days of preceding event	EPA proposes action on Revised SIP
Within 150 Days of preceding event	EPA final action on Proposed SIP
Within 30 Days of preceding event	EPA/NMED discussion concerning FIP Compliance Dates (if necessary)

